APRIL 1956

Power Engineering

This Conductor Reactance Chart Saves Figuring 67
People's Gas Building Gets Air Conditioning – Guess What System? 68
Sixty Years With POWER ENGINEERING 70
Outdoor Power Plants – An Appraisal Based on Experience 72
Report New Burner Body More Efficient 75
Would This Maintenance Control System Work for You? 76
How Sound Are Inert-Gas Tungsten-Arc Root-Pass Pipe Welds? 78
School for Nuclear Power Engineers 81
Balancing a Turbine Generator After Overhaul 82
Fuel Heat Values and Air Requirements Graphed 84
Your Feedwater Heaters – Are They Doing Their Job? 88
Which Heater Drain Pump . . . Vertical or the Horizontal Type? 90
Why Bother With Scaffolding? 92
Utilities Use More Outside Services – Should Industry? 94
Fiber-Glass . . . Power Pole of the Future 97
Save That Floor! You Might Need It! 98
Refrigerating Plant Problems – They Got Solved 101
Automation Gives D-C New Lease on Life 102

REGULAR DEPARTMENTS

Engineers' Preview 3
What They Tell Us 6
Helpful Bulletins 25
Construction News 54
Equipment News 56
News Reel 86
POWER ENGINEERING Handbook 104
New Engineering Books 112
Catalog Library 133
Reader Service Post Cards 133
Advertisers' Index 140
Circulation of This Issue 37,860

Hardened, Honed Seats

for tough throttling service

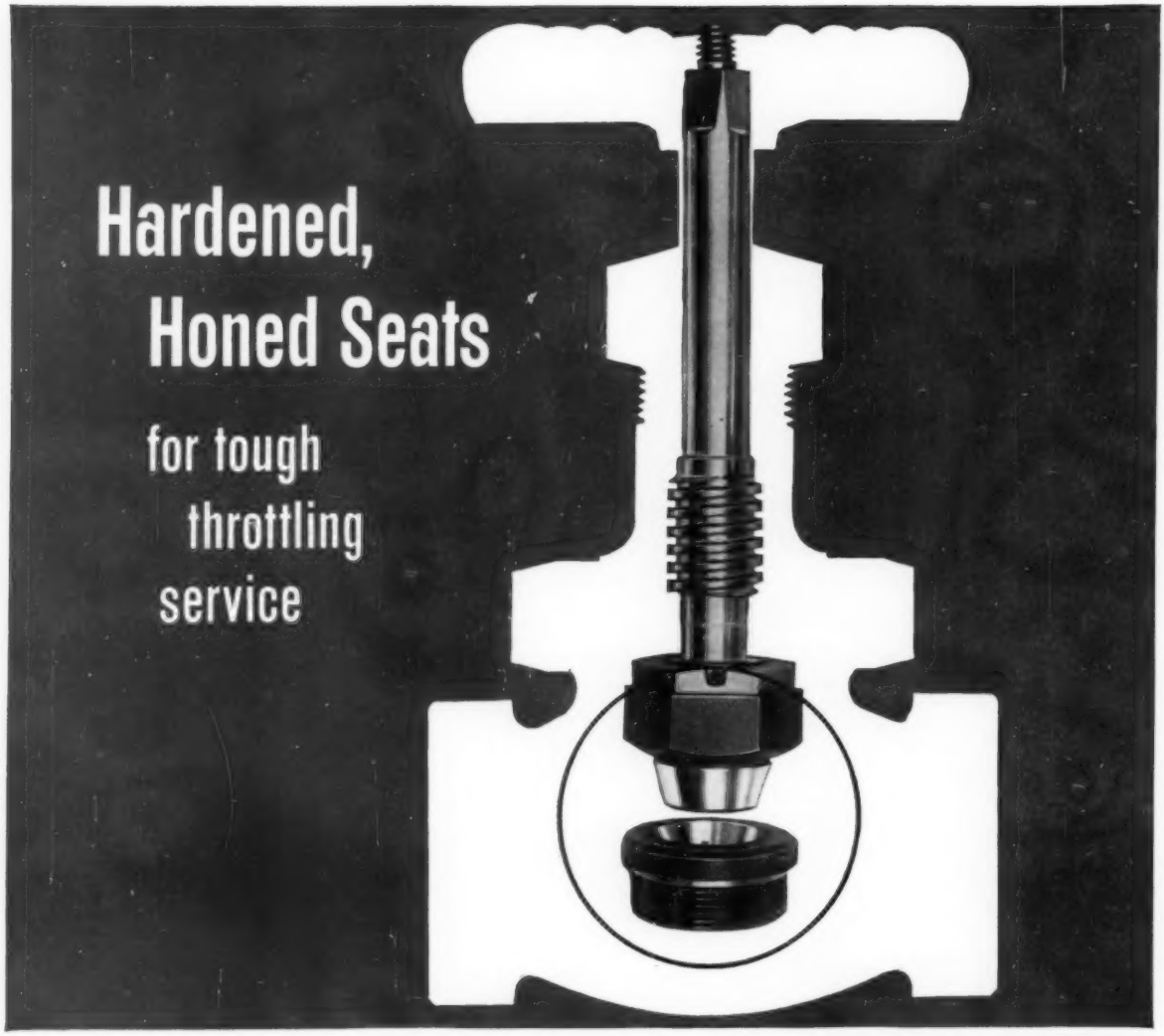


Fig. No. 558, bronze globe valve, 200 lbs. WSP, @ 550°F., 400 lbs. WOG, non-shock

A plug-disc and seat so hard they can crush scale between them and still close tight. A stem that absolutely will not gall or seize. The combination is in a rugged bronze valve designed for tough throttling service . . . the OIC 558!

Both plug-disc and seat are stainless steel, heat-treated to more than 500 Brinell hardness. Their seating surfaces are ground and *honed* to an accurate, smooth, bearing finish. The stem is OIC *alloy-40*, a sturdy bronze which won't gall or seize.

Remember, in throttling service a valve's stem, plug-disc and seat must withstand the most abusive wear. Rely on the toughness designed into this OIC line to give you extra-long service. Specify the modern 558 where you need bronze globe valves for throttling.

Write for Form No. 1001 which describes this valve along with the entire OIC 500 line, including composition disc and spherical disc globes, angles and check valves.

Call your OIC Distributor.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

P-507

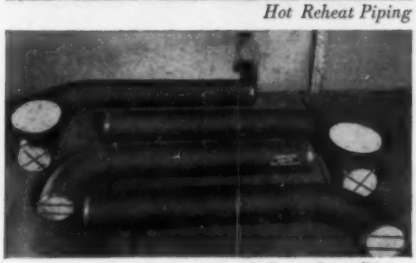
VALVES | **FORGED & CAST STEEL, BRONZE & IRON, LUBRICATED PLUG VALVES**

For more data circle 501 on Post Card

Manual metallic-arc field welding. Electric coils, wound around areas adjacent to weld, are used in preheating, and in local stress relieving after completion of weld.

Main Steam Piping

Hot Reheat Piping



Cross-Over Piping

Shop fabricated assemblies above are produced to sizes which installation and shipping facilities permit.

FIELD ERECTION by P.P.&E.

Assures Safe, Efficient Operation of HIGH TEMPERATURE, HIGH PRESSURE PIPING

Pittsburgh Piping and Equipment Company was among the first to recognize the importance of complete piping fabricating service, including the responsibility for erection of the piping system.

At P.P.&E. sub-assembles are shop fabricated in sections as large as shipping facilities and installation area permits, are checked for dimensional alignment, and delivered ready for accurate erection. Field welds are planned for maximum accessibility. Consequently, erection by skilled, specially trained craftsmen is facilitated.

An experienced P.P.&E. field organization handles all erection problems, and coordinates field work with shop fabrication so that materials arrive on schedule, and in the sequence which permits erection to proceed rapidly and efficiently.

PRODUCTS AND SERVICES

Carbon Steel Piping	Forged Piping Materials
Cast Iron Fittings	Headers
Cast Steel Fittings	Manifolds
Chrome-Moly Piping	Pipe Bends
Copper Piping	Stainless Steel Piping
Corrugated Piping	Van Stoning
Creased Bends	Welded Assemblies
Expansion Bends	Welded Stainless Steel Tubing
Flanges	Welding Fittings

PP-15

Pittsburgh Piping
AND EQUIPMENT COMPANY
158 49th Street — Pittsburgh, Penna.
CANADA: CANADIAN PITTSBURGH PIPING, LTD.
835 BEACH ROAD—HAMILTON, ONTARIO

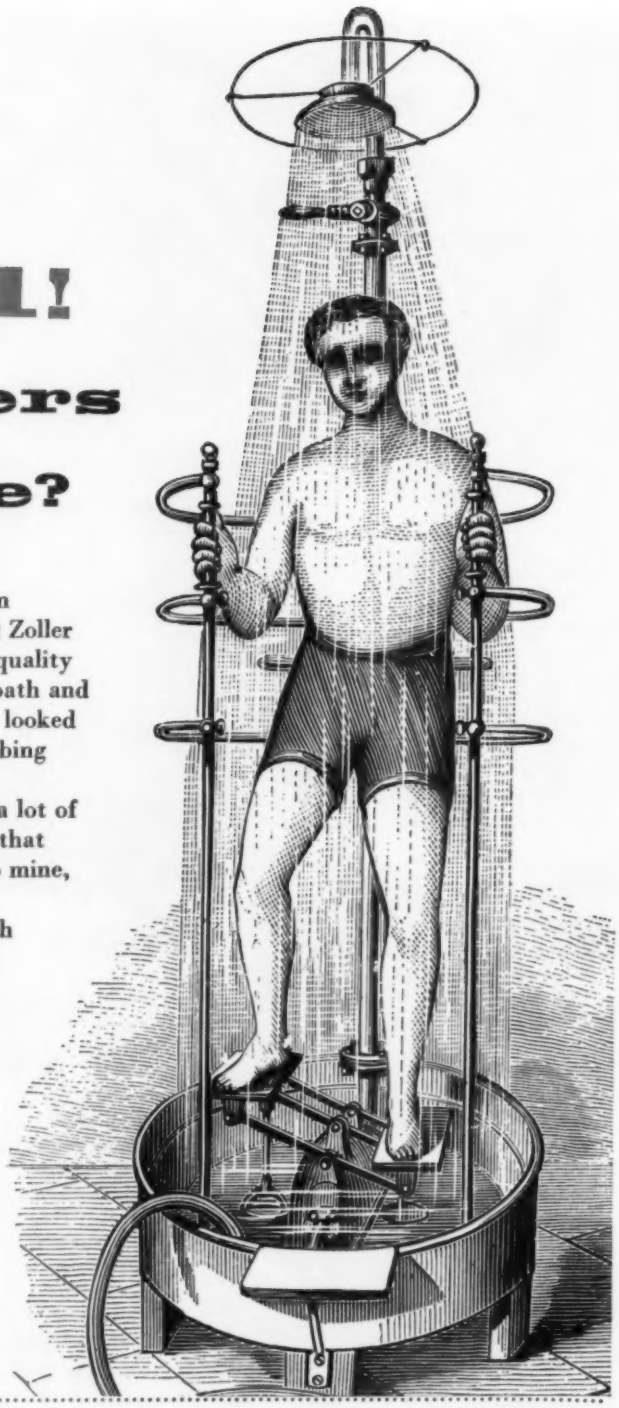
OFFICES IN PRINCIPAL CITIES

Atlanta	Whitehead Building
Boston	10 High Street
Chicago	Peoples Gas Building
Cleveland	Public Square Building
Houston	Heights State Bank Building
Los Angeles	1830 North Alexandria Ave.
New Orleans	P. O. Box 74
New York	Woolworth Building
Syracuse	113 So. Salina Street
Toronto	68 Yonge Street
Washington	Wire Building

For more data circle 502 on Post Card

Egad!

will wonders never cease?



Patented! Warranted! A marvel of modern ingenuity! Yes, back in 1886, when Bell & Zoller first started marketing their famous high-quality coals, this combination leg-pump shower bath and morning workout was all the rage—and it looked like the new-fangled fad of "indoor" plumbing was here to stay!

Yes, we've come a long way, and made a lot of changes since then. But there's one thing that hasn't changed. 70 years ago we set out to mine, process and deliver the best possible selection of free-burning, high-heat, low-ash coals—by the best, low cost, most modern methods available.

And we're still doing that job in 1956!

* * *

You know these coals by the famous brand names of ZEIGLER, MOSS HILL, ORIOLE, MURDOCK, LIBERTY SMOKELESS, BUCKHORN... and you can be sure of fast, low cost delivery through your nearest Bell & Zoller office—today!

Bell & Zoller Coal Company

70 YEARS OF SERVICE TO COAL USERS

BELL BUILDING, CHICAGO 1, ILLINOIS

Detroit • New York • St. Louis • Minneapolis
Omaha • Milwaukee • Louisville • Washington, D.C.
Terre Haute, Ind. • Mount Hope, W.Va.

For more data circle 503 on Post Card

EDITORIAL AND BUSINESS STAFF

POWER ENGINEERING IS PUBLISHED MONTHLY
110 S. DEARBORN ST., CHICAGO 3, ILL.
DEARBORN 2-5446

EDITORIAL AND ART STAFF

Editorial Director	Richard H. Morris
Editor	Andrew W. Kramer
Executive Editor	Chester R. Earle
Associate Editor	Norman S. Jones
Associate Editor	R. C. Hagenmiller
Equipment Editor	Marian E. Heniken
Assistant Editor	Irene M. Glen
Editorial Assistant	Mildred Novosel
Staff Artist	James E. Wilcox
Chief Draftsman	Robert W. Koster

OFFICERS AND BUSINESS STAFF

President	Kingsley L. Rice
Executive Vice President	Edwin C. Prouty
Treasurer	Arthur L. Rice, Jr.
Assistant Treasurer	Thomas Walsh
Secretary	Edwin C. Prouty, Jr.
Production Director	John O. Aarvold
Production Manager	Earl R. Noren

DISTRICT MANAGERS

New England 5 Spring St., Riverside, Conn.	Charles R. Lippold NEptune 7-2210
New York 17, N. Y. 1613 Graybar Bldg.	Joseph Halloran MUrray Hills 5-3779
Philadelphia, Pa. 1235 Jericho Road (Abington, Pa.)	Oscar Wilde TUrner 7-6688

WESTERN SALES MANAGER

John R. Morrison

Pittsburgh 19, Pa. 404 Frick Bldg.	James B. Tafel COurt 1-4878
Cleveland, Ohio (Euclid 23) 451 Clearview Drive, Suite D	Edmund M. Ingersoll REdwood 2-7734
Chicago 3, Ill. 110 S. Dearborn St.	John R. Morrison, Warren F. Saas DEarborn 2-5446
Seattle 4, Wash. 1008 Western Ave.	Harry Abney ELliott 3767
San Francisco 5, Calif. 615 Market St.	Les Meek YUkon 60-647
Los Angeles 5, Calif. 3727 West Sixth Street	Connie J. Grabb DUnkirk 7-5391
Denver 2, Colo. 222 Colo. National Bank Bldg.	Robert Heidersbach KEystone 4-4669
Houston 6, Texas Room 214, 3214 Montrose Blvd.	Frank Vickery JAckson 9-6711
Dallas 6, Texas 5526 Dyer St.	Ed. J. Whetzle FOrest 8-5510

Change of Address: Send to POWER ENGINEERING, Circulation Division, Barrington, Illinois. Please supply your position title, company name, company address. Request must reach us by 15th of month to make the change, effective with the following month's issue.

Subscription Information: Published monthly; price in the United States and its possessions $10, in Canada $11, other countries $12 per year; single copies $1.

Indexed in the Industrial Arts Index and the Engineering Index on file in public and many private libraries.

Microfilm edition: Request prices from University Microfilms, Inc. Ann Arbor, Mich. All volumes since 1948

Copyright 1956 by Technical Publishing Co., Chicago, Illinois. Accepted as controlled circulation publication at Concord, New Hampshire.

NBP BPA

PUBLISHED SINCE 1896 FOR POWER ENGINEERS IN PRIVATE AND PUBLIC UTILITIES AND INDUSTRIAL PLANTS

ENGINEERS' PREVIEW

NEW KIND of professional service for industrial management is announced by Technical Advisors, Inc. This firm is a group of scientists, engineers and administrators, organized to help top management obtain the best solution to technical and economic problems in the fields of product and process development, product diversification, industrial engineering, and applied research in science and engineering.

Technical Advisors does not perform the functions of other technical or economic consultants, but instead serves as counsellor and client's representative in dealing with such consultants. Brochure describing these services is available on request from Technical Advisors, Inc., Municipal Court Bldg., Ann Arbor, Mich.

. . .

MARINE GAS TURBINE to operate at temperature of 2,200 F — nearly twice presently-adopted temperature level — is being developed at Pametrada Research station, England.

. . .

ACCORDING TO COLONEL R. B. White, chairman of the committee, test work on the coal-burning gas turbine now under development by Locomotive Development Committee of BCR at Dunkirk, New York, is expected to reach completion in 1956. It is anticipated that the first coal-burning gas turbine locomotive will be under construction in 1957.

The 1956 program will be carried out in the Turbine Test Facility maintained by the Committee at the Alco Products Plant in Dunkirk, New York. The testing will include improvements in coal handling, combustion, and ash separation equipment. Later in the year, additional tests will be run on the Committee's 4250-hp locomotive type turbine now installed on a stationary test bed.

Effective January 1, 1956, Peter R. Broadley of Elizabeth, N. J. has become Director of Research for the Committee succeeding John I. Yellott. Mr. Broadley, on leave from his post as Mechanical Engineer of the Central Railroad of New Jersey, has been L. D. C.'s Assistant Director of Research since 1947. Mr. Yellott will become Secretary of the Association for Applied Solar Energy and Assistant Director of Stanford Research Institute, with headquarters at Phoenix, Arizona, as noted in POWER ENGINEERING, January 1951 issue.

. . .

UNITED STATES' FIRST National New Products, New Methods and Patents exposition will be held in Detroit in the fall of 1956 under the combined sponsorship of civic, management and labor organizations in cooperation with private industry and state, municipal and federal government agencies. Offices of the show will be at 927 Book Building, Detroit, Mich. Athel F. Denham has been named exposition director.

. . .

THREE HYDRAULIC turbine contracts totalling about $2,750,000 have been awarded the S. Morgan Smith Co. The contracts, calling for six turbines, were placed by The Portland (Ore.) General Electric Co., the Montana Power Co., and the Puget Sound Power & Light Corp. of Seattle.

S. Morgan Smith will build three 135-in. Francis turbines for installation at the Pelton Hydro-Electric Development site of Portland General Electric on the Deschutes River, 120 miles southeast of Portland. These turbines will develop 55,000 hp at 138.5 rpm under a 150-ft. head.

Two 180-in. five-bladed Smith-Kaplan turbines have been ordered by Montana Power for its H. H. Cochrane Hydro-Electric Development on the Missouri River seven miles from Great Falls, Mont. Each will produce 42,000 hp under a net head of 80 ft at 128.6 rpm

The Puget Sound Power & Light Corp. has ordered a 79-in. Francis turbine for its Snoqualmie Fall Sound Plant No. 2, about 20 miles east of

Seattle. The turbine will develop 28,000 hp at 300 rpm under a 272-ft head.

• • •

NOW BEING USED to coat surgical instruments is KEL-F Fluorocarbon Plastic, thereby making them safer to use in areas where high-frequency, high-voltage electrical current is required. It is common practice to use electrical current in the neurosurgical operating room for prevention of bleeding, coagulation of bleeding points, and coagulation of isolated nerve roots and residual tumor tissue.

If there is a short circuit between instrument and tissue, normal tissue may be burned; coagulation does not occur when desired; and adjacent nerves or nerve roots may be affected by spread of the current.

Protective sheaths of rubber and other plastics have been suggested for insulation, but for various reasons (thickness, inability to withstand sterilization, difficulty of applying to instruments of varying shapes and contours with equal effectiveness) these are all limited in actual use. But the plastic gives most satisfactory results.

• • •

YOU WILL DOUBTLESS want to know that passenger fares and freight rates have been quoted for transporting humans and their goods to and from an inhabited satellite station, which will have to be placed in a permanent orbit around the earth before the accomplishment of true space flight can begin. In this station men can work and live for extended periods independently of the support of the Earth's surface or its atmosphere.

Here, for the first time, men will have taken leave of the planet Earth to go out into true space and conduct operations appropriate to that location and environment. From this vantage point they will begin to reap the potential benefits of space flight, and acquire the experience, knowledge, and skill that will enable them to carry on from this station the succeeding exploits of space flight to other points beyond.

All this was explained by D. C. Romick of Goodyear Aircraft Corp. in a paper before the Twenty-Fifth Anniversary Annual Meeting of the American Rocket Society in November 1955 at Chicago.

To accomplish this goal, he said, we must be able first to build a ferry rocket vehicle capable of being flown regularly from the Earth's surface to such an orbiting station, and back, carrying an effective load of passengers and cargo; and, second, to build a suitable station in the orbit for support of the personnel involved, and for carrying out appropriate operations.

After explaining how such structures can be developed, from an engineering point of view, the author tabulates estimated costs of transportation to the station and back, as follows:

	To Station	Return from Station
Passengers	$40,000	$15,000 Round Trip $50,000
Mail	$0.75 an ounce	$0.15 an ounce
Express	$20 per lb.	$5 per lb.
Freight	$8 per lb., or $16,000 per ton	$2 per lb., or $4,000 per ton
Building Material for Station	$20,000 per ton	
Fuel and Supplies	$20,000 per ton	
Bulky or Fragile Equipment	$25,000 to $30,000 per ton to Station Return — $5,000 to $6,000 per ton.	

• • •

AMERICAN SOCIETY for Testing Materials has just issued Part 1 — Ferrous Metals, of its 1955 Book of ASTM Standards. Containing 1834 pages and 315 standards, Part 1 is 11 per cent larger than the 1952 edition and contains 125 standards that are new or have been revised since the 1954 Supplement was published a year ago. Since 1952, 211 standards are new or have been revised. It contains 1832 pages and costs $13.50. Remaining parts of the 1955 Book of ASTM Standards will be published by the Society as rapidly as the editorial and press work can be completed, with the last part expected off the presses about February 1956. For more information about it, write American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Penna.

WOULD YOU LIKE TEAR SHEETS?

Readers wanting tear sheets of any article appearing in the issue for their personal file may obtain them by indicating the item desired on one of the post cards appearing in this issue—Editors.

COAL STORAGE MANUAL
Reprints Available

REPRINT copies of POWER ENGINEERING 24-page Coal Storage Manual, which appeared first as a Special Feature in the March issue, are now available in limited quantities to interested readers.

Whether you store coal on the ground, or in bins, bunkers and silos, you will find information of value in this comprehensive report on the latest coal storage practice.

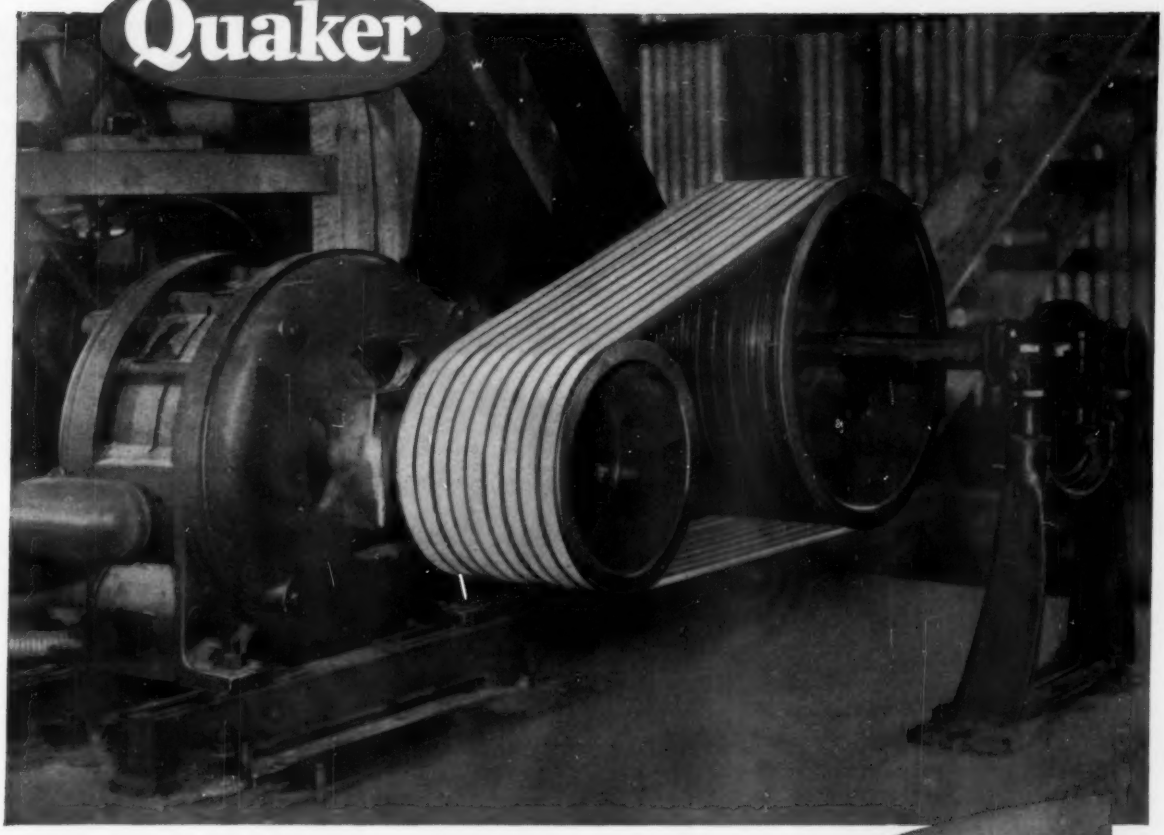
If you would like to have a copy, write the Editor, 110 S. Dearborn St., Chicago 3, Ill., and one will be sent free of charge as long as supply lasts.

LET'S HER AND HIM FIGHT! With its January issue, *The Bulletin of the Atomic Scientists* enters its second decade; its first issue having appeared in December 1945. In an article in that issue, Ten Years That Changed The World, its Editor, Eugene Rabinowitch, explains the origin of its symbolic cover design. "A year and a half after the first appearance of the *Bulletin*," writes Dr. Rabinowitch, "Edward Teller sketched its now familiar cover design — the clock with the hands ominously pointing to a few minutes before midnight." Midnight, of course, represents the hour of doom when the atomic bombs wipe out what we like to call our civilization.

A day after the appearance of the January issue of the *Bulletin*, a correction note arrived via first class mail calling attention to the fact that Dr. Rabinowitch's statement is misleading. Says the correction note, "The idea of using the clock with its hands pointing to a few minutes before midnight was Martyl's (Mrs. Alex Langsdorf), the Art Editor of the *Bulletin*, and so was the actual designing of the cover. Dr. Teller was a member of the editorial board of the *Bulletin* who, in a meeting in which different sketches of the cover were compared, supported the simple and stark design showing only a quarter of the clock's face occupying practically the whole cover. This was the incident to which the article made reference."

It's a good cover but we should like to see it run backward a little. Two minutes to midnight is too close.

Quaker



Low stretch, high flexing

stands up to shock impacts

Cut down buying costs. Order all your rubber product needs from a single source — your Quaker-Quaker Pioneer distributor. He's as near as your phone — and ready to serve you. Write for free brochure and name of nearest distributor.

Strong and tough for large heavy duty multiple pulley drives, this V-belt gives long trouble-free performance where shock loads are encountered. Made of high tensile rayon cord, pre-stretched by exclusive heat stretching process. High traction jacket encloses multiple layers of rayon embedded in premium cushion rolls. All Quaker-Quaker Pioneer multiple V-belts are perfectly matched, assuring that each belt carries full share of load. Our complete line of industrial rubber products also includes hose, packing and moulded rubber for every use.

DIVISIONS OF HKP H. K. PORTER COMPANY, INC.

H. K. PORTER COMPANY, INC.

QUAKER RUBBER DIVISION
Philadelphia 24, Pa.

QUAKER PIONEER RUBBER DIVISION
San Francisco 7, California

For more data circle 504 on Post Card

WHAT THEY TELL US

I HAVE A PROBLEM . . . wrote Albert Costa of Michigan. Perhaps some of your readers with similar experience can offer a solution:

> We have a Scotch Marine fire-tube dry-back boiler of 100 hp. We use continuous water treatment from a reliable firm. I don't know the contents of the treatment; one is liquid and the other is powder. The powder is supposed to be slow acting to react on the headers and the liquid is supposed to be fast acting to react on the tubes.
>
> The boiler water pH has been checking between 11.0 and 11.6. I have been taking condensate samples from different points in the plant and the pH and hardness have been way out of line. From one heating coil fed by live saturated steam, which is some distance from the boiler, I obtained a pH reading of 5.8 and a hardness of 1.5 grs.
>
> On checking exhaust condensate from a heating coil, I obtained a reading of 5.4 pH and 1.5 gr hardness. I took a sample from a bleeder between the boiler stop valves and obtained a pH of 6.2 and a hardness of 1.7. I checked different spots along our live steam line and found similar hardness and pH. At this point I might add that we have approximately 90 per cent make-up water, which is heated in an open heater by an exhaust steam.
>
> Why do we find these differences? Are they indications of trouble? If so, what — and how can it be cured?

We hope that our readers will heed Mr. Costa's plea. Address your replies to POWER ENGINEERING, % *What They Tell Us*, 110 S. Dearborn St., Chicago 3, Ill.

CHAIRMAN of the committee on sewers and sewage disposal plant in an Illinois community, John H. D. Blanke commented:

> In a preliminary scanning of your January issue, my attention was drawn to the article, Five Ways to Paint a Chain Link Fence.
>
> Since I have been aware for some time that the link fence around our disposal grounds needs protection against rust, I am going to show this page to the superintendent of the plant. I know he has been looking for a simple and inexpensive method of painting the fence.
>
> But the article tells nothing about preparing the surface for the painting job. It seems to me that an economical and fast way to remove dirt and rust from the fence is to use a rotary wire brush driven by an electric motor on extension cord or by a portable gasoline engine, following the wire brushing with a duster.

PERHAPS YOU CAN HELP me in a need that I have, wrote L. A. Border, Denver, Colo.

> In our hospital power plant we have two 200-hp boilers, standby power generation, hot water tank, feedwater heater, pumps, and all the other auxiliary equipment necessary to the functioning of a small plant.
>
> I feel that a more complete or adequate log sheet adapted to our small plant would be very helpful.

We have sent Mr. Border reproductions of several log sheets specifically designed for small plants, but these sheets were taken from a book published several years ago and now out of print. We know that Mr. Border would appreciate further suggestions from readers. Please send in log sheet samples or comments to *What They Tell Us*.

BUT ALAS! IT DIDN'T WORK, he said. Roby C. Wise of Los Angeles wrote us a while ago that he had read the article about a Simple Stroboscope, by L. W. Fitzpatrick, in the March 1954 issue of POWER ENGINEERING, and that he had built one.

He got the right RCA 1C21 tube and the proper resistors and he was sure the hook-up was right. He observed that the tube envelope was black and that it would not emit any light.

"You ought to go far, Albert; you got brains, ambition, a nagging wife . . ."

What was wrong?

Well, the answer is easy — and that black tube gives the clue. We pass it along just in case other readers want to make the stroboscope.

> The answer is: Between the time Mr. Fitzpatrick's article was sent to us and the time it was published, the tube manufacturer had supplied a tube coated with a protective coating. This has to be removed before using the tube, and it can be taken off with a solvent such as nail polish remover.
>
> Mr. Wise has since reported that two applications of the nail polish remover cleaned the tube perfectly and that the stroboscope functioned perfectly thereafter.

THOMAS H. WALDRON, who authored the booklet, Your Boiler Can Enjoy Water, will have color film-strip available. He wrote:

> Attached is a list of individuals and companies totaling 172 to date, whose purchase of my booklet can be directly attributed to the fine article you published in the October 1955 issue of POWER ENGINEERING.
>
> As a fringe benefit, I have received so many requests from organizations interested in group presentation, that I am now in the process of completing a color film-strip which very closely approximates the illustrations found in the booklet. This film-strip will be made available on a rental basis early in 1956.
>
> I am most grateful for the assistance you have given in the development of this booklet from the prenatal stage to its present adult status.

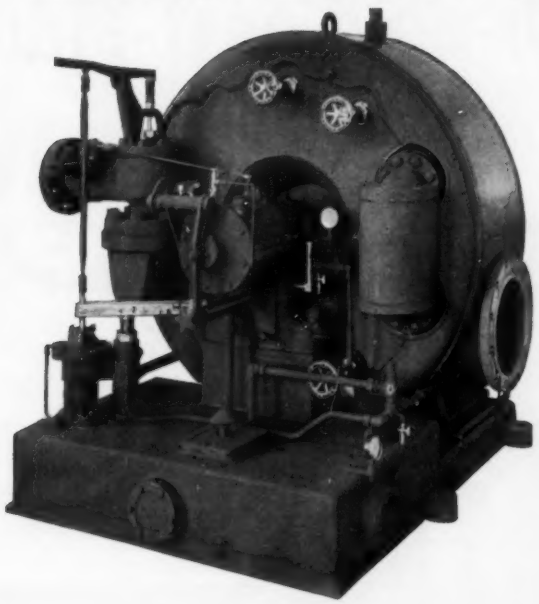
REAR ADMIRAL H. G. Rickover, USN Chief, Naval Reactors Branch, included the following note in his remarks at the Mayflower Hotel the early part of this year.

> It is reported that for two years the Russians have had in operation the most powerful nuclear particle accelerator in the world, and that some time this year they may be operating a ten-billion-volt accelerator.

INTERESTED in atomic tests? A new booklet has just been released by the Edison Electric Institute describing *operation que*. It is known as Publication No. 55–17, entitled Effects of An Atomic Blast on Electric Power Facilities. This is a much more complete report than the one given last summer in our June 3 *Atomics* newsletter. You can get a copy of the Institute's report, at a cost of 75¢, from Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y.

For a copy of our June 3 *Atomics*, write our Editor, Andrew Kramer.

TROUBLE-FREE TURBINE OPERATION STARTS HERE



Terry solid wheel turbines have become a symbol for dependable, trouble-free operation. The reason—simplicity and ruggedness of construction.

Take the rotor, for instance. It's a solid forging in which a series of semi-circular buckets is milled. There are no separate parts to loosen or work out. Since the only function of the blades is to form a series of pockets, any wear which might occur would not materially affect horsepower or efficiency.

It is impossible for the blades to foul. They have large clearances and are further protected by the projecting rims at the sides of the wheel. As the side clearances are also very large, end play can do no harm.

Simplicity outside too—as you can see from the photograph of the 1500 HP at 3500 RPM solid wheel turbine above. This turbine is equipped with an oil relay governor and forced feed lubrication to the bearings.

For more about these *work horses of industry*, send for a copy of bulletin S-116. No cost or obligation.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

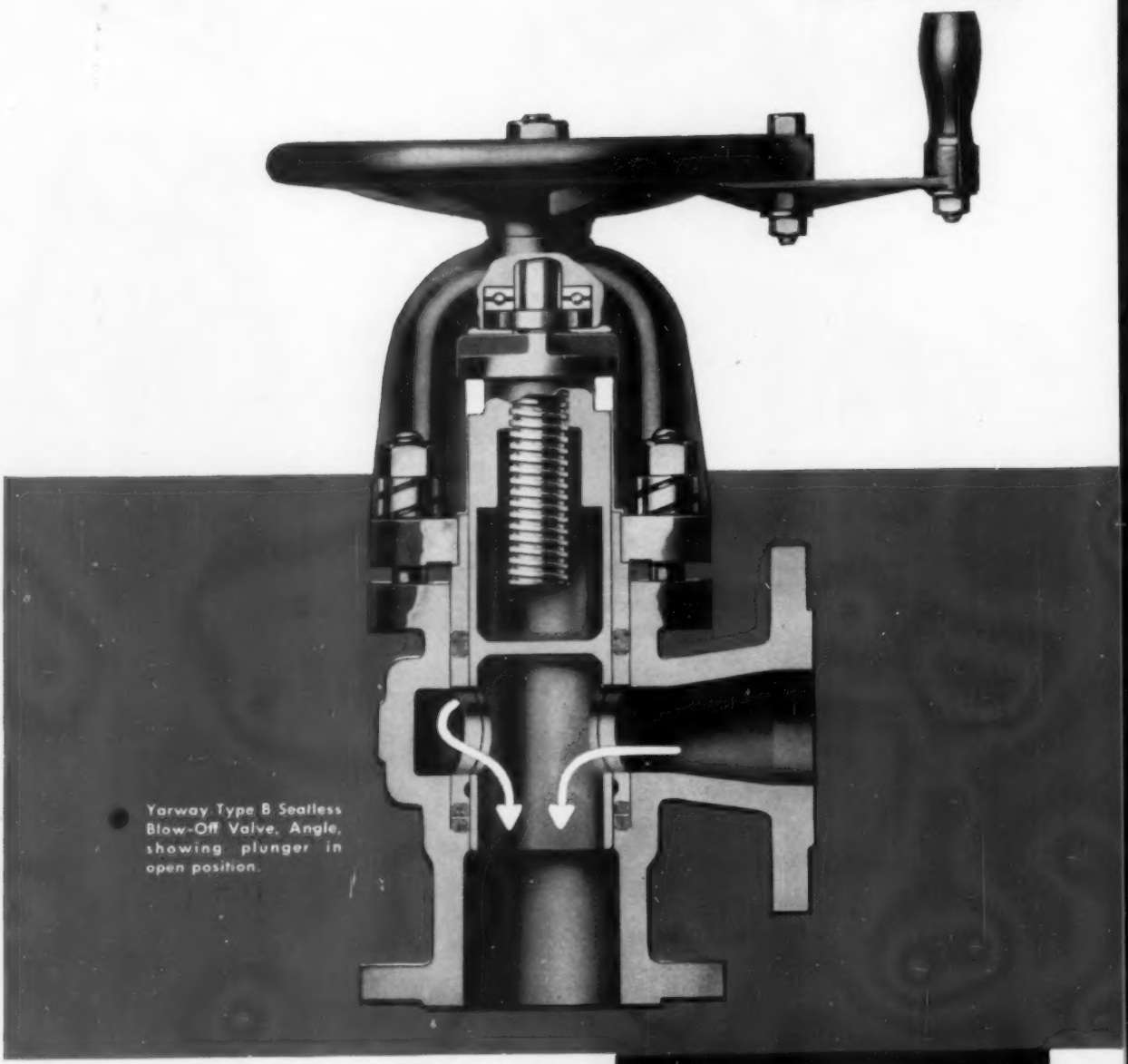
TERRY

TT-1200

For more data circle 505 on Post Card

seatless

. . . for



Yarway Type B Seatless Blow-Off Valve, Angle, showing plunger in open position.

YARWAY

trouble-free blow-down service

YARWAY SEATLESS BLOW-OFF VALVES

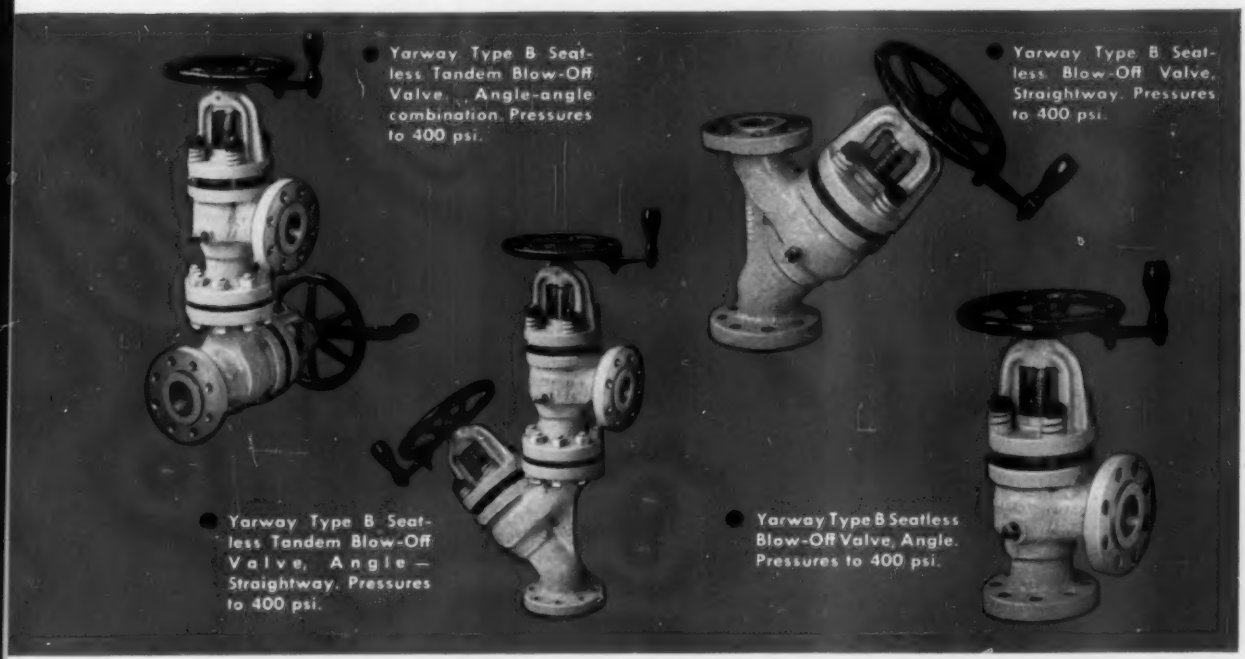
"Trouble preventers" is what YARWAY Seatless Blow-Off Valves are often called because they eliminate one of the commonest sources of trouble in low and medium pressure boiler blow-down service. *There is NO SEAT to score, wear, clog or leak.*

YARWAY Seatless Blow-Off Valves feature a balanced, sliding, hollow plunger design that permits free and easy operation—full, unobstructed flow.

More than 16,000 boiler plants today use YARWAY *Blow-Off Valves.*

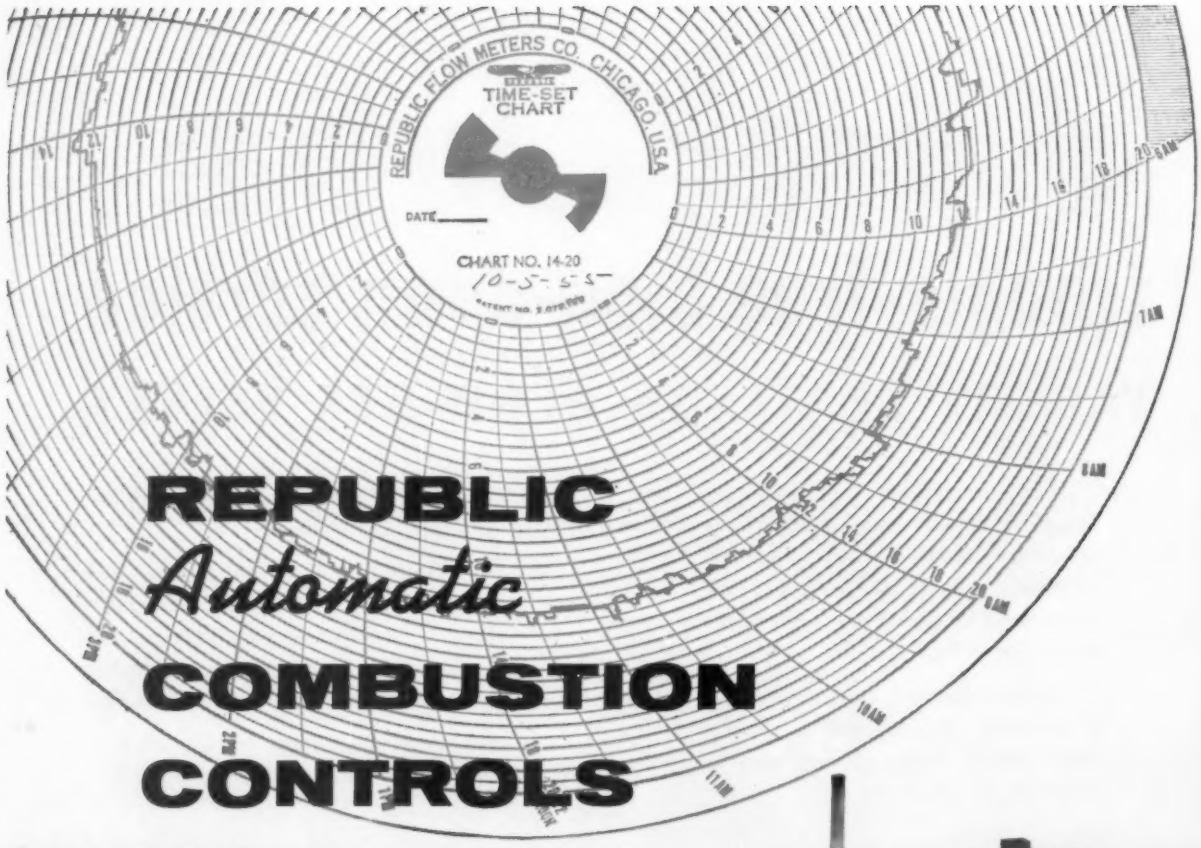
YARWAY Bulletin B-426 shows all the latest types and features of YARWAY Seatless Blow-Off Valves. If you operate your boilers up to 400 psi, you'll find a copy helpful. For higher pressures, ask for Bulletin B-434. Write today.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES


Yarway Type B Seatless Tandem Blow-Off Valve, Angle-angle combination. Pressures to 400 psi.
Yarway Type B Seatless Blow-Off Valve, Straightway. Pressures to 400 psi.
Yarway Type B Seatless Tandem Blow-Off Valve, Angle—Straightway. Pressures to 400 psi.
Yarway Type B Seatless Blow-Off Valve, Angle. Pressures to 400 psi.

— blow-off valves

For more data circle 506 on Post Card



REPUBLIC *Automatic* COMBUSTION CONTROLS

Get High CO_2 from Low Grade Coal

at UTAH-IDAHO SUGAR COMPANY'S NEW $7,000,000 PLANT

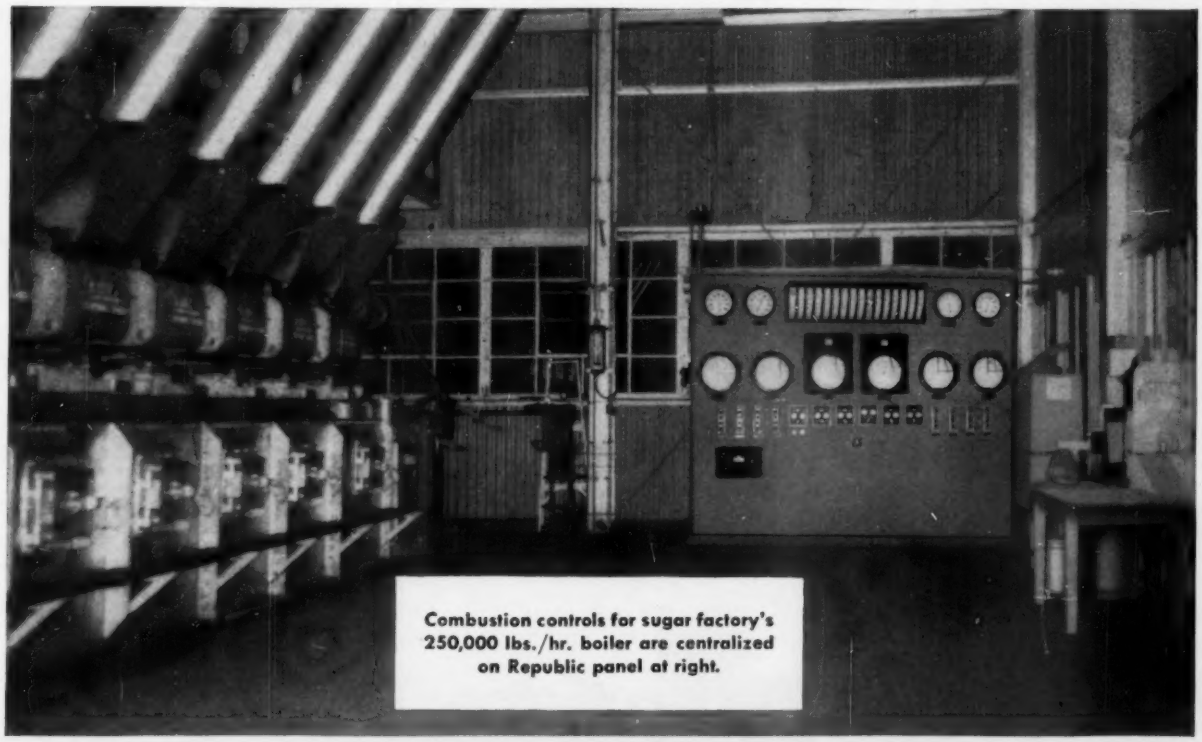
In any power plant, the percentage of CO_2 in combustion gases is indicative of combustion efficiency. But at the power plant for Utah-Idaho Sugar Company's new sugar beet factory, Moses Lake, Washington, a good CO_2 performance record is more than desirable. It's actually essential! That's because the plant supplies not only steam, but CO_2 as well to sugar-making processes. The CO_2 is extracted from combustion gases and becomes a vital ingredient in the production of over 75,000,000 lbs. of sugar and thousands of tons of molasses the factory produces annually. With the plant limited to low grade western coal, continuous maximum combustion efficiency at all loads is necessary to insure adequate CO_2 for processes.

Republic Automatic Combustion Controls enable the plant's spread stoker fired 250,000 lbs./hr. boiler

operating at 400 psig and 575°F. to meet CO_2 requirements while matching steam supply to process demands. Daily CO_2 charts indicate the boiler is consistently producing 12–13% CO_2 in spite of the quality of coal burned.

According to operators, ash removal, cleaning of the fire and soot blowing can be carried out with the combustion controls on automatic without disturbing the fuel-air ratio. Furnace draft is controlled satisfactorily despite the high stack on the plant. Turbine drives on forced and induced draft fans are speed controlled by the combustion controls, eliminating the need for dampers. A three element Republic boiler feedwater system is also tied in with the combustion control system to automatically supply the proper amount of water to the boiler at all steaming rates.

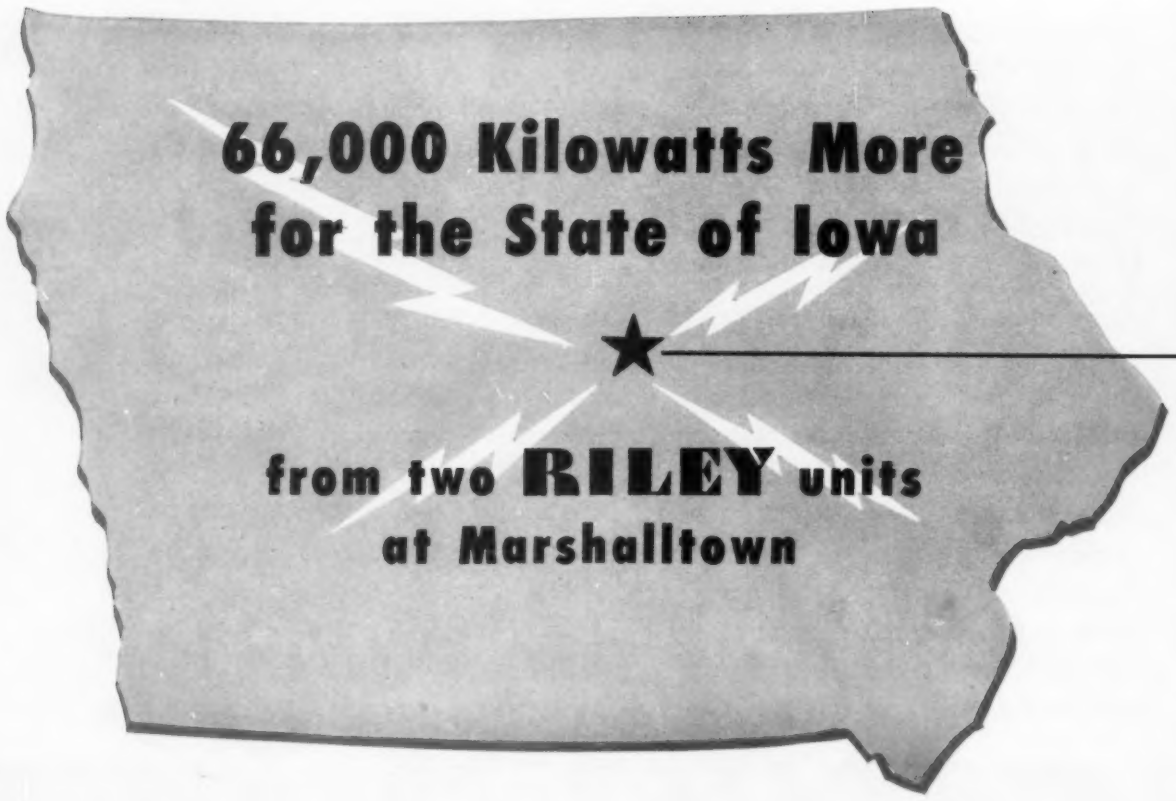
This plant is one more example of how Republic combustion engineers design control systems that enable boilers to exactly meet individual plant requirements. There are Republic Combustion Controls for any size or type of boiler, for all methods of fuel firing, all arrangements of draft and all load conditions. When you want to be sure of getting maximum boiler performance, ask Republic to design and build your combustion control system.



Combustion controls for sugar factory's 250,000 lbs./hr. boiler are centralized on Republic panel at right.

REPUBLIC FLOW METERS CO.
2240 Diversey Parkway, Chicago 47, Illinois

For more data circle 507 on Post Card

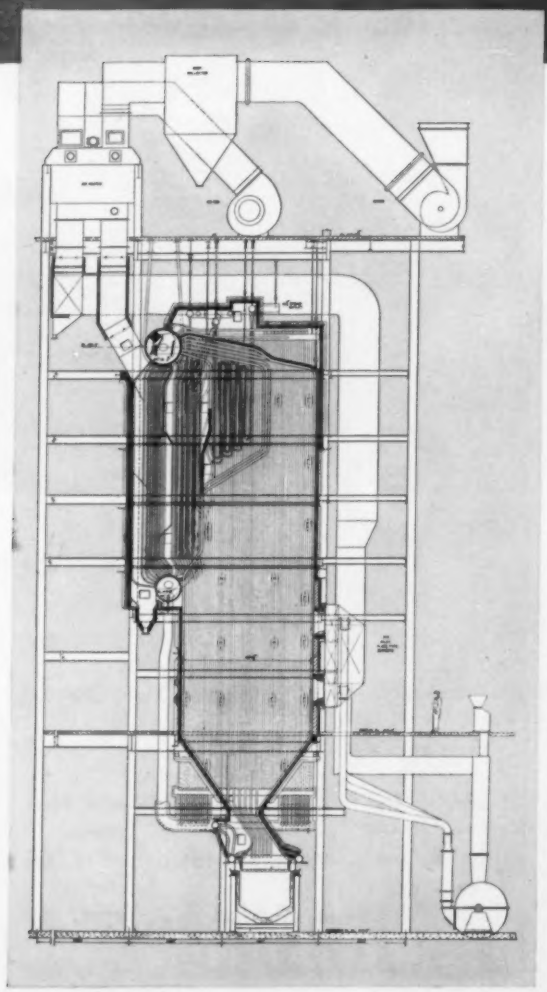


Iowa Electric Light & Power Company is helping to make Iowa a brighter place to work and live by adding to its expanding system the Sutherland Generating Station with its 66,000 Kw. capability. Two new highly efficient Riley Steam Generating Units provide the steam and are the latest Riley units to go on the line in Iowa. They are the second and third Riley units installed in the Iowa Electric Light & Power Company system.

The first Riley unit was placed in operation in September 1953 at the Boone Generating Station of the Iowa Electric Light & Power Co. This was a complete Riley unit having a capacity of 275,000#/hr at a pressure of 675# and a steam temperature of 835°.

A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

RILEY DESIGNS, MANUFACTURES AND INSTALLS COMPLETE STEAM GENERATING UNITS AND FUEL BURNING EQUIPMENT FOR PUBLIC UTILITY AND INDUSTRIAL POWER AND HEATING PLANTS



Sutherland Generating Station at Marshalltown produces 66,000 Kw. from two 300,000#/hr Riley Steam Generating Units with steam at 875 psig and 915 F.

Furnaces Designed for Burning Low Grade Coals and Natural Gas.

Adequate furnace design insures clean furnace and boiler surfaces when burning Iowa coals with low fusion temperature ash. Flexibility of design permits rapid change of fuel as desired. Riley heat exchanger type steam temperature control maintains design steam temperature over full load range with both coal and gas.

Complete Riley Units under One Contract.

Each unit is equipped with six Riley Burners for firing natural gas and coal, and three #550 Riley Pulverizers . . . a typical instance in which the advantages of Riley fuel burning equipment are ideally suited to the fuels to be burned. Tungsten carbide used in Riley mills resists the extreme erosion effects of abrasive coals to assure continuity of operation and low maintenance.

RILEY

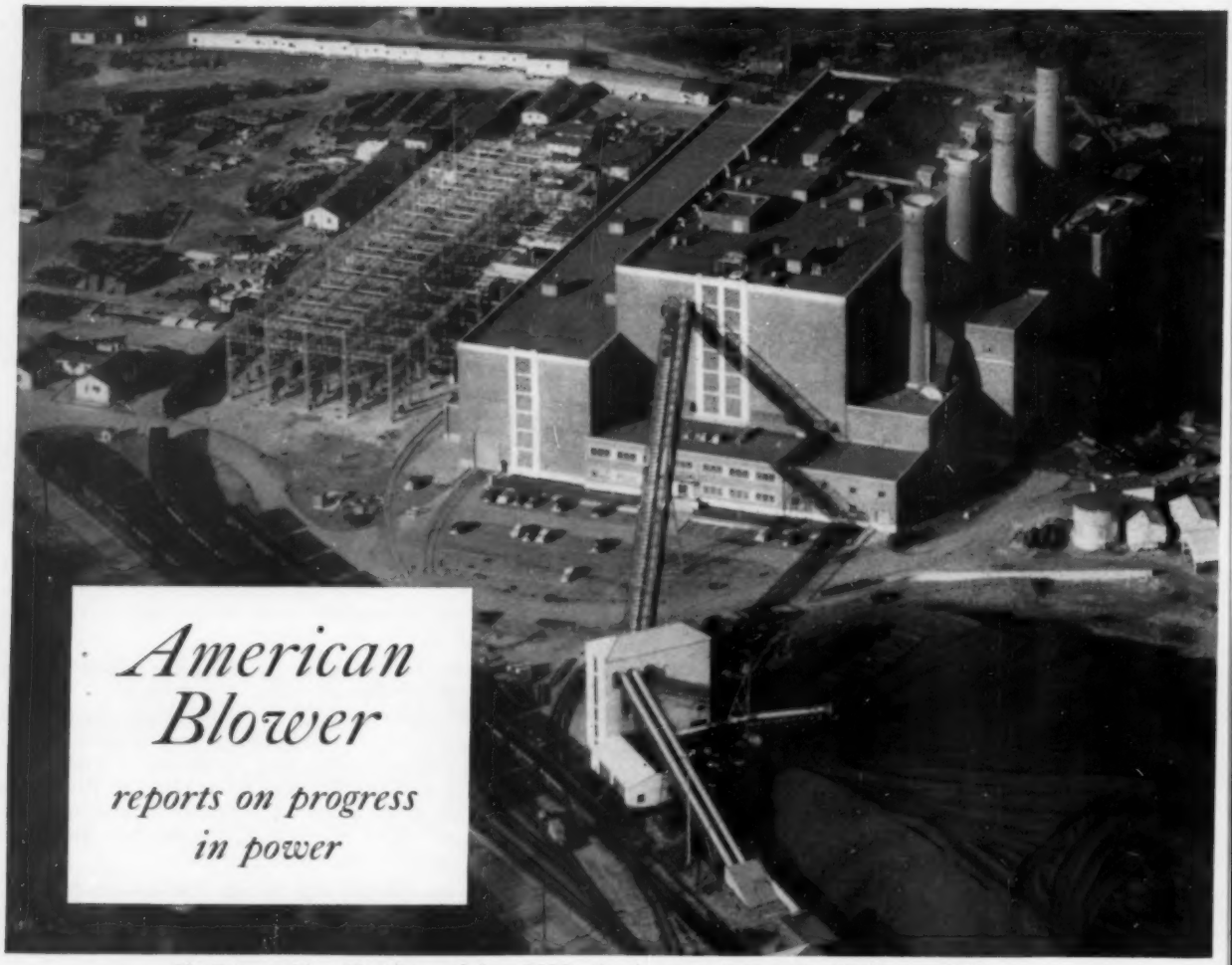
Stoker Corporation

WORCESTER, MASSACHUSETTS

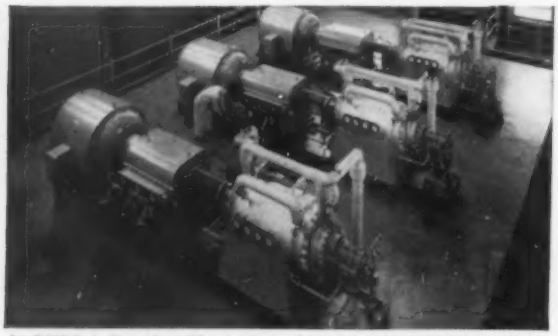
Sales Offices: Worcester, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

For more data circle 508 on Post Card

Potomac Electric Power



The Potomac River Plant is one of three PEPCo electric-power giants serving Washington, D.C., and nearby areas of Maryland and Virginia.



At PEPCo's Benning Plant, three American Blower Gyrol Fluid Drives provide adjustable-speed control for boiler-feed pumps. Each is rated at 1250 hp at 3600 rpm. Six Gyrol Fluid Drives for the same application are installed at the Potomac River Plant—each is rated at 1750 hp at 3600 rpm.

American Blower Forced Draft Fans are also installed at the Potomac River Station. Fans on Boilers 1 and 2 are rated at 113,000 cfm @ 100°F @ 11.0" sp @ 1150 rpm. Fans on Boilers 3 and 4 are rated at 111,000 cfm @ 100°F @ 17.5" sp @ 700 rpm.

records all-time peak load:

810,000 kw

Potomac Electric Power Company's new high peak load of 810,000 kw in 1955 marked a 9.3% increase above the peak of the previous year. Although it was appreciable, the boost is only the beginning.

The coming years will see the continuation of an expansion program in which Potomac Electric Power Company has been engaged since the close of World War II . . . to better serve its more than 320,000 customers in the District of Columbia, and areas of Maryland and Virginia. During the 14-year period, 1947 to 1960, additions to PEPCo's electric plant are expected to total $320 million.

As an important part of its power build-up, PEPCo relies on American Blower Mechanical Draft Fans for efficient air handling and Gyrol Fluid Drives for smooth power transmission.

Like PEPCo, many other progressive utilities depend on American Blower equipment to meet rigid power-plant demands. Perhaps we can serve *you,* too. Call our nearby branch office for full data on our Mechanical Draft Equipment, Fly Ash Precipitators, Heavy Duty Steam Coils, and Gyrol Fluid Drives for boiler-feed pump and fan control.

American Blower Sirocco Induced Draft Fans service four boilers at the Potomac River station. Latest fans are rated at 160,000 cfm @ 250°F @ 18.0" sp. @ 667 rpm.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN • CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American-Standard

AMERICAN 75th ANNIVERSARY YEAR **BLOWER**

For more data circle 509 on Post Card

"We prevented Field complaints and motor Burnouts — by protecting our sewing machine drive motors with FUSETRON FUSES."

"By 1949, increased sewing machine speed and stepped-up production tempo were putting an added burden on the drive motors we make for Singer Sewing Machine Co.

"It was necessary to find a more effective way to protect these industrial sewing machine motors — otherwise, we might expect increasing motor burnouts and field complaints.

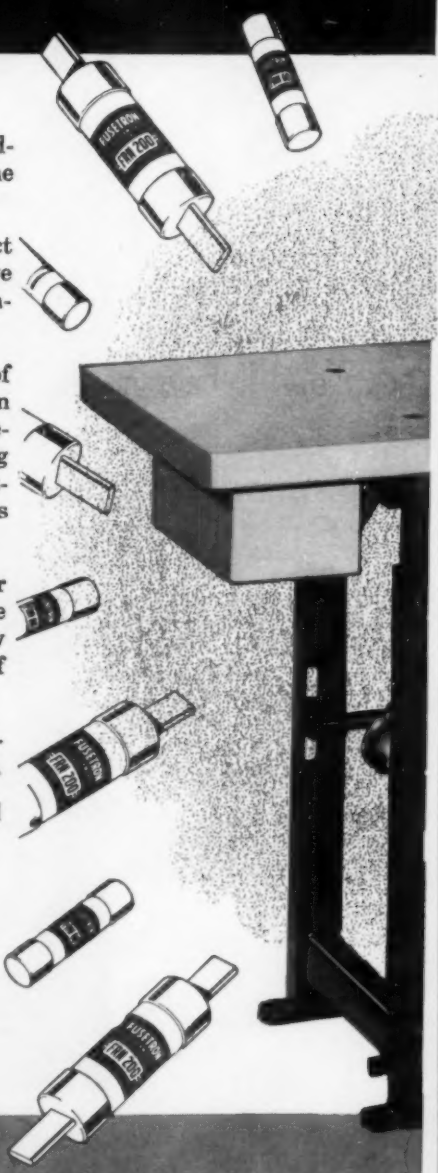
"An extensive test was conducted on the application of Fusetron dual-element fuses of motor-running protection sizes. Our investigation showed that Fusetron fuses, because of their time-lag, would hold the motor starting current. They also would absorb the current surges resulting from starting the sewing machines 40 or more times per minute.

"In addition, Fusetron fuses would safely take the motor off the line if the branch circuit was single phased. We were particularly interested in this finding because we knew this type of power supply fault could give us a lot of trouble.

"On the basis of our tests, we decided to provide individual Fusetron fuse protection as standard equipment.

"As we expected, this decision practically eliminated motor burnouts and prevented field complaints."

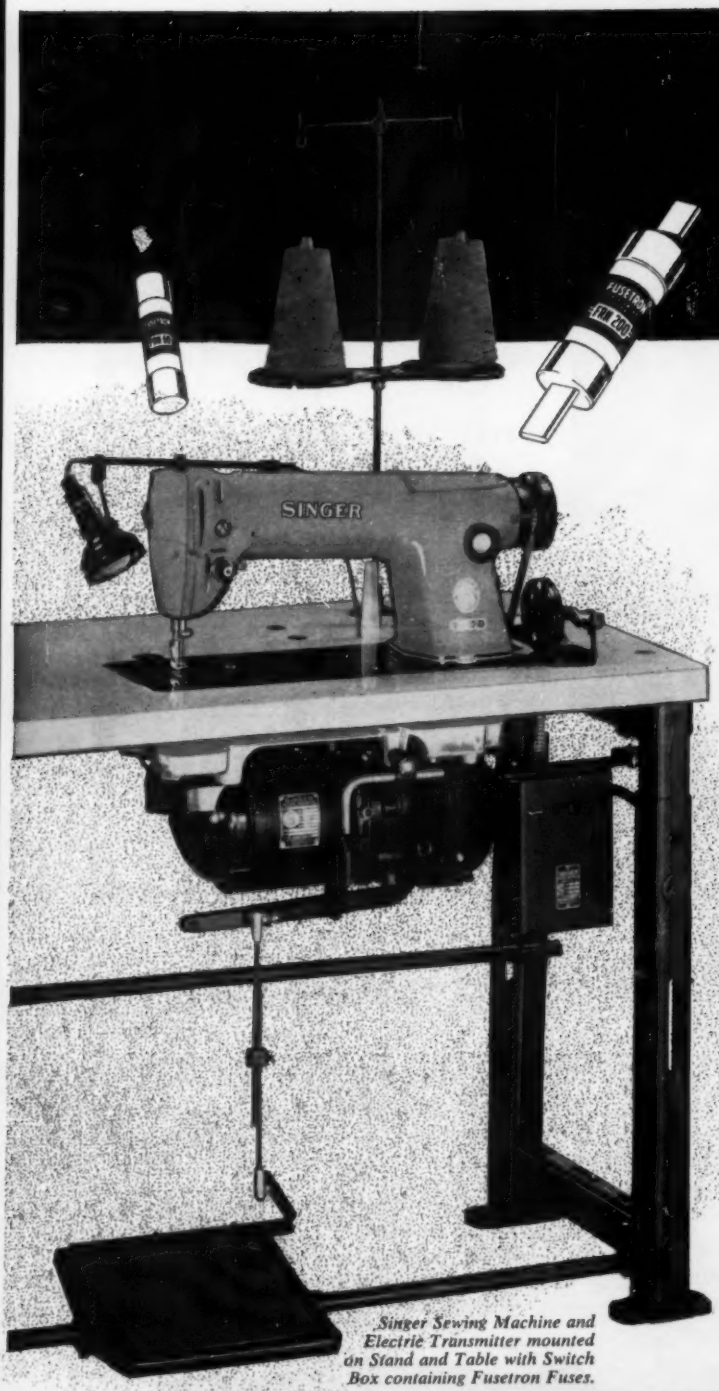
R. D. Ingalls,
CHIEF ENGINEER
DIEHL Mfg. Co.
Electrical Division of
The Singer Manufacturing Co.
SOMERVILLE, N. J.



Play Safe! **install Fusetron Fuses and BUSS Hi-Cap Fuses throughout the entire Electrical System.**

You too, can eliminate Protection Troubles with FUSETRON FUSES . . .

They provide 10 point protection.



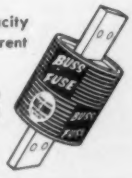
Singer Sewing Machine and Electric Transmitter mounted on Stand and Table with Switch Box containing Fusetron Fuses.

1. High interrupt capacity — protect against heavy short-circuits. Have proven on tests to open safely on circuits set to deliver in excess of 100,000 amperes.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloads.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnouts.

FOR LOADS ABOVE 600 AND UP TO 5,000 AMPS., . . . Use *BUSS Hi-Cap Fuses*

They have an interrupting capacity sufficient to handle any fault current regardless of system growth.

They can be coordinated with Fusetron fuses on feeder and branch circuits to limit fault outages to circuit of origin.



On new construction, tell your architect to specify this Safer, Better Protection.

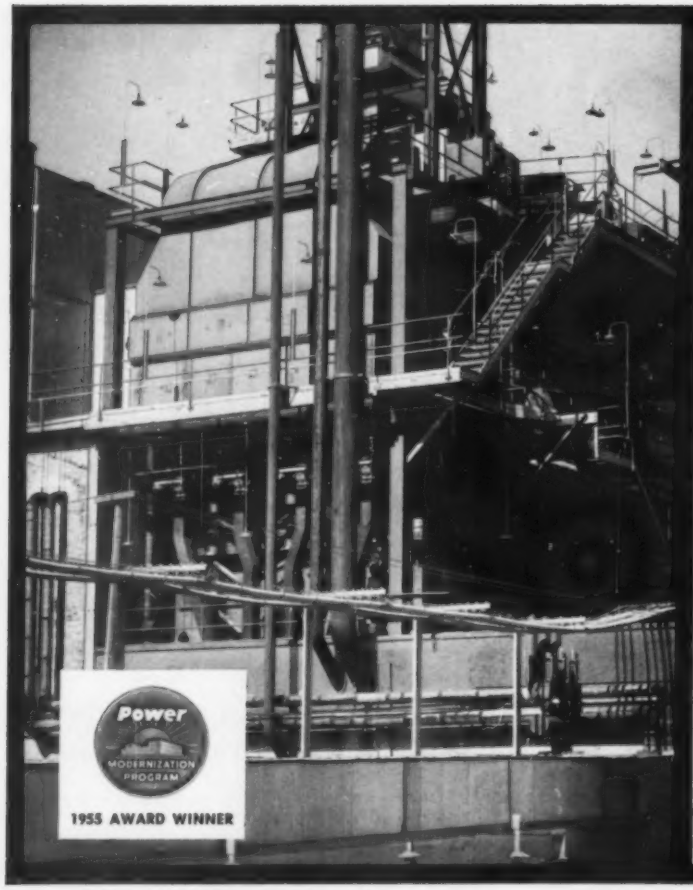
396

For detailed information on Fusetron dual-element fuses and BUSS Hi-Cap fuses, write for bulletin FIS and HCS.

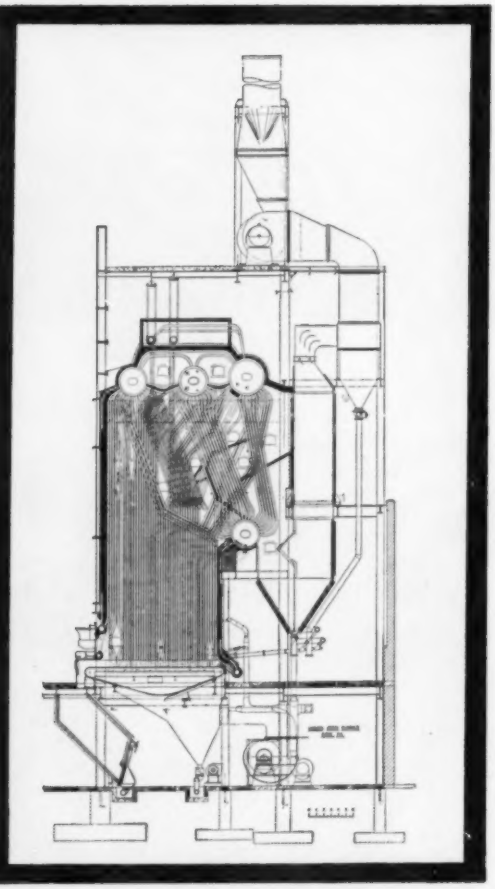
BUSSMANN MFG. CO. *(Division of McGraw Electric Co.)*
UNIVERSITY AT JEFFERSON ST. LOUIS 7, MO.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

For more data circle 510 on Post Card



John Strange Paper Co., Menasha, Wisconsin



Longitudinal Section of Union Boiler

165,000 lbs/hr Union Boiler plays key role as John Strange wins power modernization award

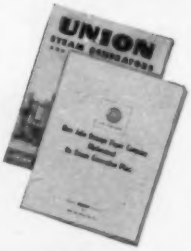
Named 1955 winner of POWER Magazine's Modernization Award, John Strange Paper Company is ranked with the leaders in its industry on the basis of BTU's used per ton of paper produced.

In remodeling its power plant, John Strange followed the recommendations of Cummins and Barnard, Inc. A Union 4-drum boiler was installed to supply steam for both electrical power and processing.

With a steaming capacity of 165,000 lbs/hr at 725 psig and 825° F, this Union semi-outdoor boiler has played a key role in helping boost paper production 10% while saving 29% in fuel costs without increasing plant personnel.

From start to finish, the report "How John Strange Paper Company Modernized Its Steam Generation Plant" is an interesting example of planning power services around a process. It typifies the way in which Union Boilers perform in numerous industrial installations from coast to coast.

GET FULL DETAILS
Both a copy of this story, as it originally appeared in POWER, plus illustrated Catalog GB-153 showing several types of boilers built by Union, will be mailed on request. Write.



UNION

UNION IRON WORKS
ERIE, PENNSYLVANIA

For more data circle 511 on Post Card

CONDENSER TUBE CLINIC

Edited by Arthur W. Tracy,
Metallurgical Engineer,
The American Brass Company,
Waterbury, Connecticut

25 Years' Experience has proved the Value of Arsenic as an Inhibitor

Research at The American Brass Company nearly a quarter of a century ago showed that about 0.04% arsenic would inhibit dezincification of brass, and this amount of the element has been added to Admiralty metal and aluminum brass since then.

Inland power stations find that ANACONDA Arsenical Admiralty-439 serves well under normal water conditions, its arsenic content effectively inhibiting dezincification.

Tidewater power stations must contend with much more corrosive waters, and ANACONDA Ambraloy-927, the arsenical aluminum brass, is preferred because it is not only resistant to dezincification but also to impingement or erosion pitting by either clean or polluted sea waters flowing at relatively high velocities.

Oil refineries have virtually made ANACONDA Arsenical Admiralty-439 standard for refinery condensers and heat exchangers handling crudes, rerun stocks, cracked products, lubricating oils, and by-products. It is resistant to dezincification and can handle corrosive cooling waters at relatively high temperatures. Another important property is its ability to withstand attack by sulfur compounds resulting from the refining of sour crudes. ANACONDA Ambraloy-927, because of its resistance to dezincification and to pitting corrosion by sea water at relatively high velocities, is sometimes preferred in oil refineries on tidewater.

Marine users generally find ANACONDA Arsenical Admiralty-439 satisfactory for inland-water vessels and also for seagoing vessels where service conditions are moderate; but ANACONDA Ambraloy-927 is preferred for most seagoing vessels. Both alloys are resistant to dezincification under all corrosive conditions found in these services.

Your own needs may call for these corrosion-resistant Anaconda alloys or they may call for other tube alloys we make. Our Technical Department will be glad to help you select the one best alloy for the conditions you face.

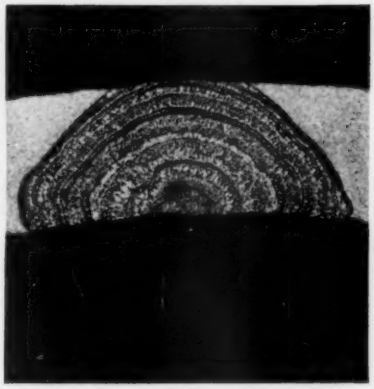
Technical Service—Get full information on our technical services and products by writing The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 8878

APPROXIMATE MECHANICAL AND PHYSICAL PROPERTIES
(Light Annealed Tubes)

	Arsenical Admiralty-439	Ambraloy-927
Tensile Strength, psi.	52,000	60,000
Yield Strength, 0.5% Elongation, psi.	22,000	27,000
Elongation in 2", %	60	55
Rockwell Hardness "B"	6-45	35-65
Density, Lb./cu. in.	0.308	0.301
Thermal Conductivity, B.T.U./Sq. Ft./ In./Hr./ °F. at 68°F.	768	696
Coefficient of Linear Expansion, Average per °F. (77°-572°F.)	0.0000112	0.0000108

TWO TYPES OF DEZINCIFICATION IN NONARSENICAL CONDENSER TUBES

(approx. 120X)
LAYER-TYPE DEZINCIFICATION on the inner wall of an uninhibited Admiralty metal tube from an oil refinery using polluted fresh water.



(approx. 17X)
PLUG-TYPE DEZINCIFICATION on the inner wall of an uninhibited Admiralty metal condenser tube from a power plant operating on tidewater.

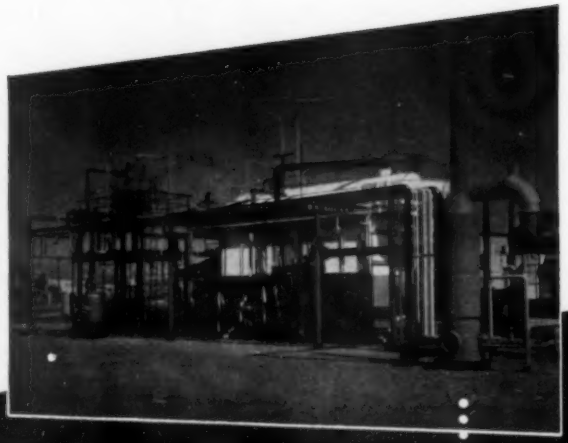
ANACONDA®
Tubes and Plates for Condensers and Heat Exchangers

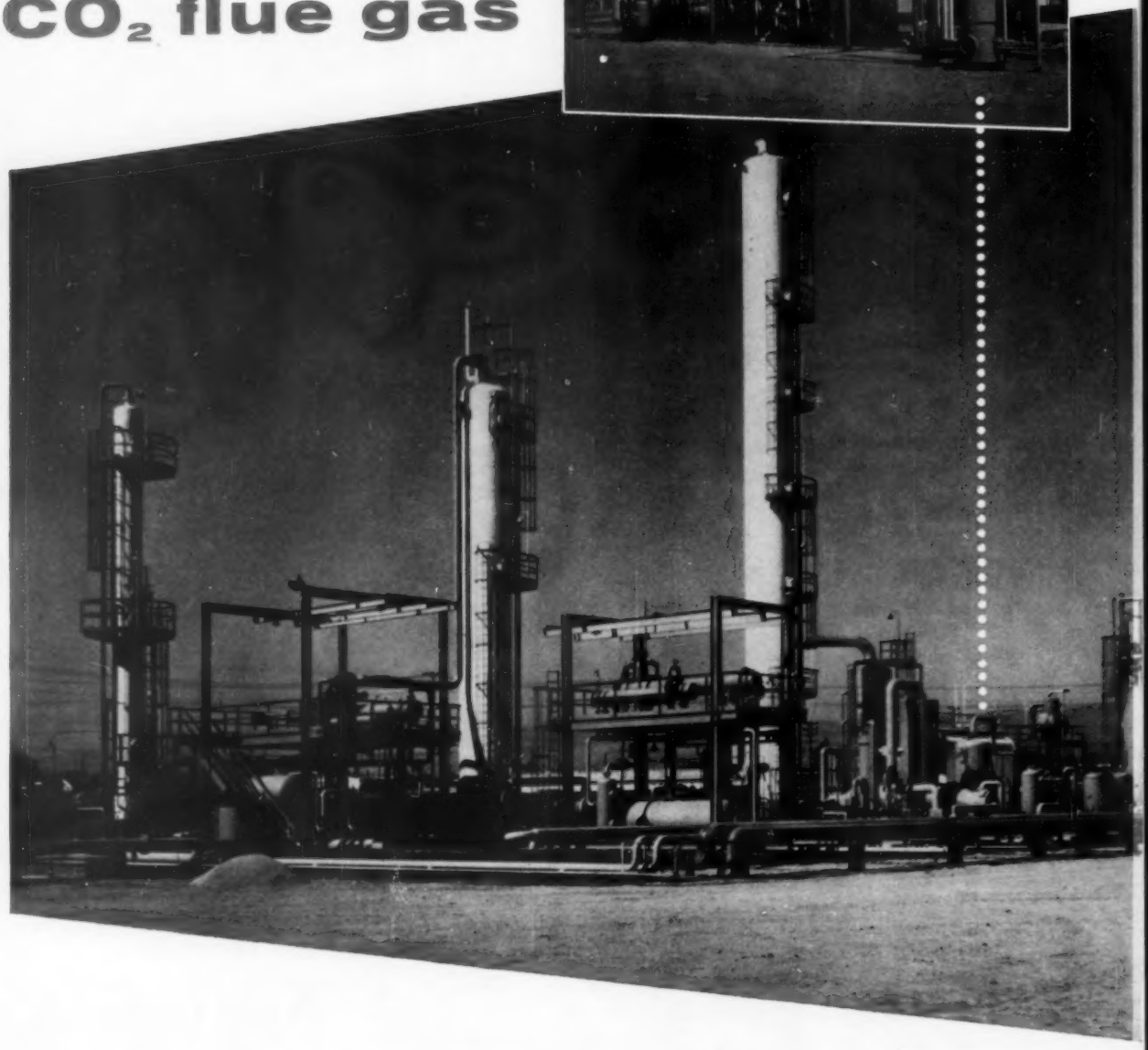
For more data circle 512 on Post Card

Everything depends on

ERIE CITY VL
selected because of its high---

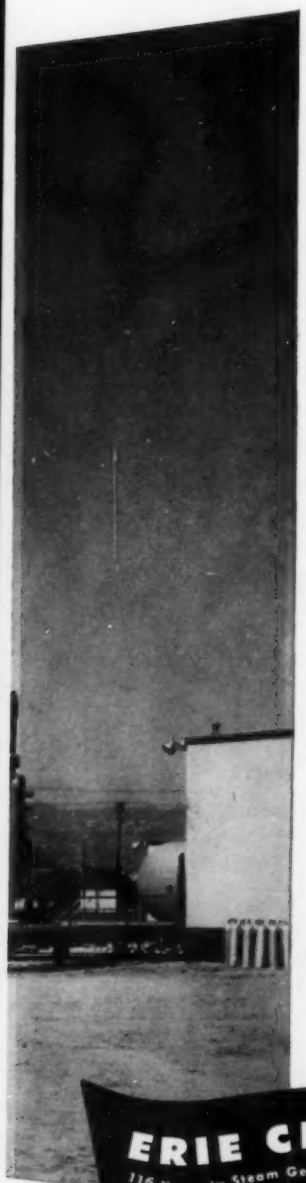
CO_2 flue gas





--the boiler flue gas ~ at this $1,500,000 Liquid plant

Liquid Carbonic Corporation, world's largest producer of CO_2 in liquid, gas and dry ice forms, operates the world's most automatic processing plant, of its kind, at Oakland, California



• Boilers used in the manufacture of dry ice and liquid CO_2 are specially designed and are an integral part of the process. When Liquid Carbonic specified the quantity of CO_2 to be produced at its Oakland, California plant, Erie City engineers met their stringent requirements. They designed and built the boiler, holding excess air to a minimum, while insuring complete combustion to obtain a high CO_2.

The entire operation at this plant is dependent upon the quantity of CO_2 that leaves the boiler. Unlike other boilers, steam production in this VL is incidental but is fully utilized to power the process.

Liquid Carbonic Corporation has for years found Erie City boilers dependable in this unique, severe application. The Oakland, California installation is one of many with Erie City boilers.

You, too, can depend on Erie City for sound engineering. Whatever type of steam generator you require, remember that Erie City designs and manufactures the most complete line, including all major components, to offer one single responsibility. There's over 116 years of experience to serve you.

If you would like the complete story on the Erie City VL write for SB-433.

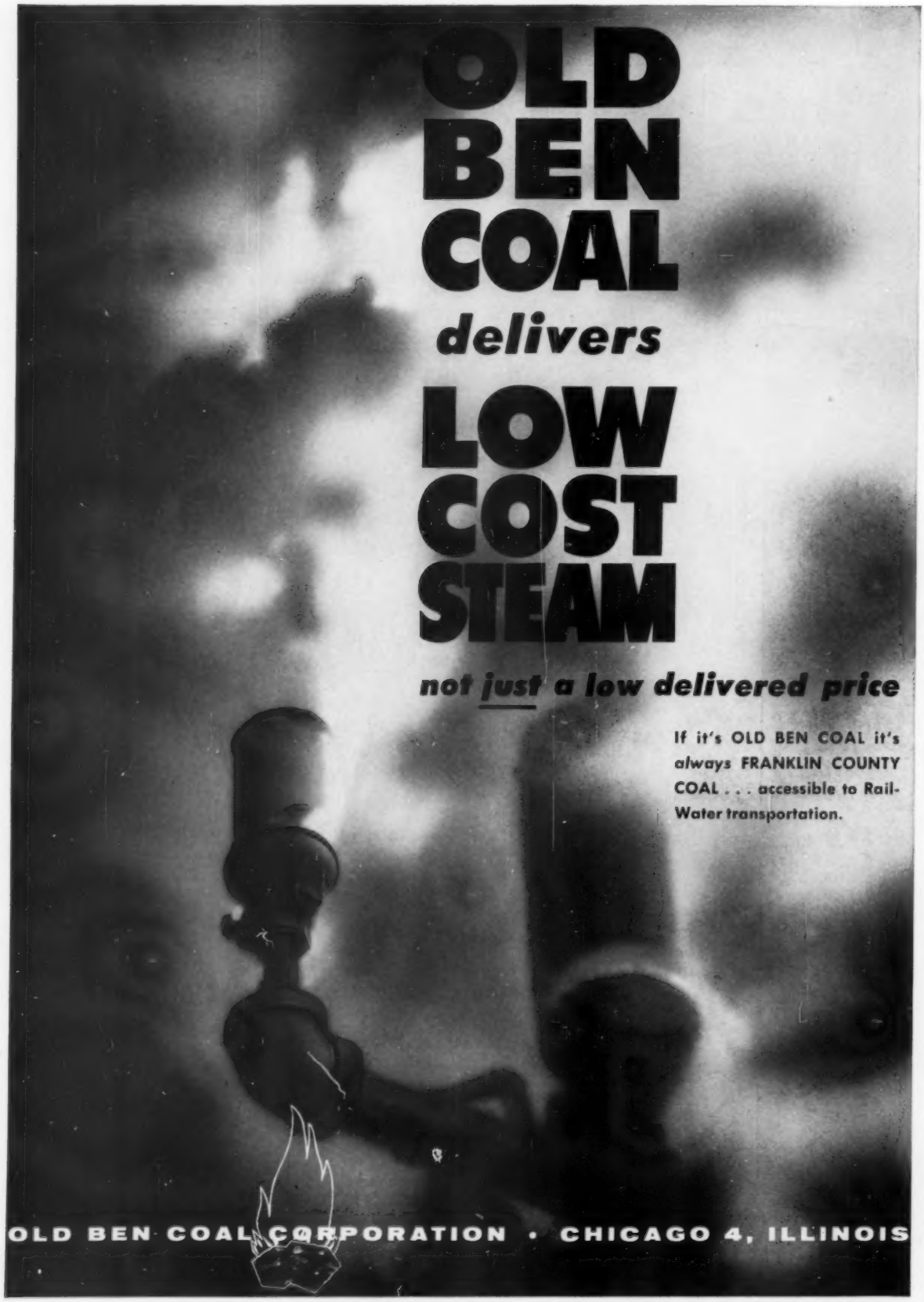
ERIE CITY
116 Years in Steam Generation

You can depend on Erie City for sound engineering

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

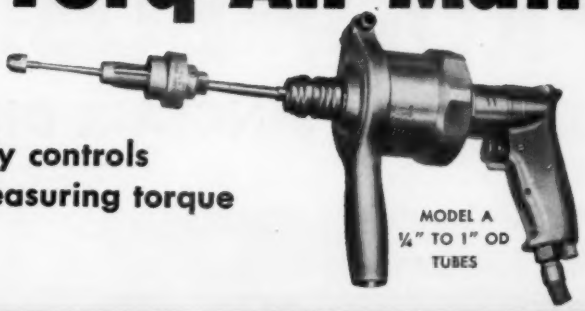
For more data circle 513 on Post Card



For more data circle 514 on Post Card

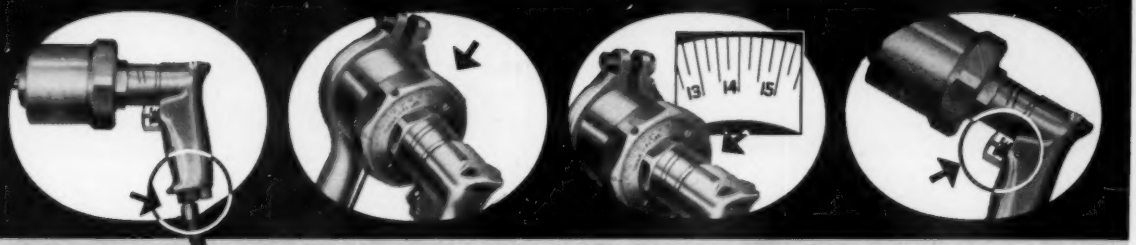
New WILSON Torq-Air-Matic

First and only air-driven tube expander drive that accurately controls tube expansion by directly measuring torque output at the mandrel.



MODEL A
¼" TO 1" OD
TUBES

Look at these exclusive design features of the WILSON Torq-Air-Matic

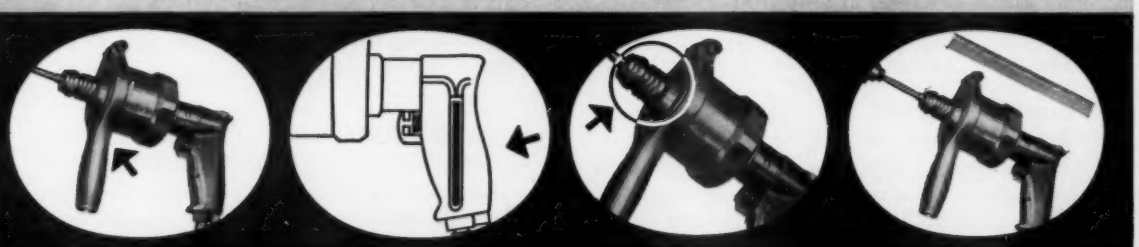


AIR-DRIVEN—Only air-driven tube expander drive with a built-in torque control. *Does not require a separate control box, relays or switches.* No extra cables or wires; just one small air hose serves it.

CALIBRATION—The only tube expander control calibrated *in terms of foot pounds torque instead of meaningless arbitrary units.* Torque requirements for expanding tubes of off-standard jobs can be more readily arrived at.

POWERFUL—Rated to deliver *fourteen foot pounds torque* at 90 psi. This is sufficient to roll 1" OD x 11 gauge boiler tubes.

SIMPLE—Only a *single three-position trigger throttle* for off, forward and reverse. Never any danger of over-rolling because of improper sequence of operation. No juggling of switches; nothing new to learn.



CONVENIENT—*Furnished with an auxiliary handle that can be swivelled to any position desired* by the operator or left off when the torque reaction is not too great. Basic unit is of a pistol grip design.

TROUBLE-FREE—*Has an oil reservoir* built into the handle to supply lubrication to the motor. *The control section is independent of the motor and lubricated for life.*

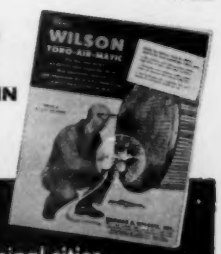
CHUCK—*Simple, new type, snap on floating chuck. Only one motion* instantly engages or disengages a square shank mandrel—no set screws.

COMPACT—*Only 10" overall* from pistol grip handle to instant action chuck.

TW 850

These features speak for themselves. The Wilson air-driven Torq-Air-Matic tube expander drive and control is an important revolutionary advance in the field of precise tube expanding. Here's what you get when you use the Wilson Torq-Air-Matic control for heat exchanger tubes: (1) uniform and tight pressure joints, regardless of tube sheet hole variation; (2) no over-rolled or under-rolled tubes—no stresses that shorten tube life; (3) extended tube expander life, more production, higher profits.

SEND FOR BULLETIN 55



THOMAS C. WILSON, INC.

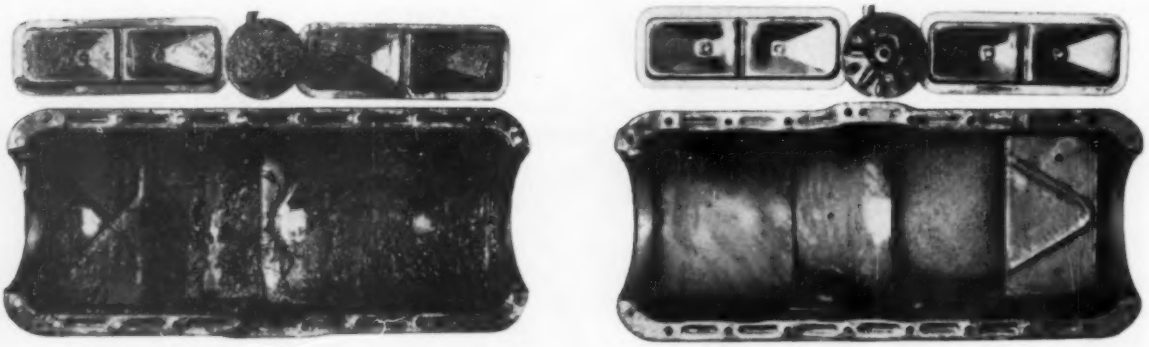
21-11 44th Avenue, Long Island City 1, New York • Representatives in all principal cities

MANUFACTURERS OF TUBE CLEANERS, TUBE EXPANDERS AND TUBE-MAINTENANCE TOOLS

For more data circle 515 on Post Card

PROOF POSITIVE...

of SINCLAIR Diesel Oil Superiority!



This is actual photographic proof of the superiority of Sinclair Diesel Lubricants. On the left is a truck engine sump in which an ordinary oil was used. The clean sump on the right reflects conditions when a Sinclair Diesel Oil, SUPER TENOL, was used. This same top quality lubrication performance can be expected from all Sinclair Diesel Oils . . . *because Sinclair has the exact oil to match your engine's requirements!*

Sinclair RUBILENE®— These high viscosity index oils, refined by Sinclair's famed Phetone Process, have a long history of outstanding performance and are extensively used in stationary Diesel power plants today.

Sinclair RUBILENE HD — These high viscosity index oils contain additives which provide excellent detergent — dispersant properties, oxidation resistance, bearing corrosion prevention and anti-foam qualities. They are especially suitable for stationary Diesels as well as the higher speed Diesels used in industrial plants.

Sinclair GASCON®—These naturally detergent, straight mineral oils are recommended for slow, medium and high speed Diesels where carbon deposits, engine cleanliness and easy, low temperature starting is important.

Sinclair GASCON HD — Heavy duty detergent type oils compounded with selected additives to provide extra detergent dispersant properties, bearing corrosion prevention, oxidation resistance and anti-foam characteristics.

Sinclair TENOL®, SUPER TENOL and TENOL EXTRA—A series of heavy duty, detergent—dispersant type, high viscosity index oils refined by the Sinclair Phetone Process. Recommended for all high speed automotive fleet Diesel engines, and for some engines of late design in stationary, portable and marine service. All three series contain varying degrees of additive concentrations necessary to give outstanding performance no matter what the service condition under which your Diesel operates.

For further information about Sinclair's trouble-proof Diesel lubricants, see your Sinclair Representative, or write Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*

SINCLAIR

DIESEL OILS

For more data circle 516 on Post Card

HELPFUL BULLETINS

PUMPS, PUMPING

101 Condensate, Vacuum Pumps — Bulletin 1465, 28-pp, describes company's Type S condensate pump and complete line of vacuum and condensate pumps. Large cut away illustrations, pump selection guide and installation diagrams are included. Engineering data are tabulated. Sarco Co., Inc.

102 Fire Pump — Bulletin B-1500, 36-pp, describes and illustrates horizontal centrifugal fire pumps, with selection charts and a set of typical fire pump specifications included. Pumps are listed into groups according to types of drive. Also included are descriptions of standard single stage and multi-stage pumps, as well as typical installation arrangements. Fire pump fittings, tank filling and jockey pumps, and pump installations are shown. Peerless Pump Div., Food Machinery and Chemical Corp.

103 Centrifugal Pumps — Bulletin 1020 describes company's Series DE double-ended seal-less canned motor centrifugal pumps, and includes cutaway view showing construction details. Includes performance details, dimensions, and operating principles. Chempump Corp.

104 Improved Pumps — High efficiency and low maintenance of company's Wheeler-Economy Type M pumps are stressed in 8-pp Catalog A-155. These pumps are designed for medium and high head services. Cross section of design are shown for bottom and side suction types, and construction details are included. C. H. Wheeler Mfg. Co.

105 Air, Vacuum Pumps — Capacities, dimensions, performance curves and other engineering data on manufacturers rotary air and vacuum pumps are provided in 12-pp Catalog 755. Covers four- and two-wing types, double-cylinder type, motor-driven models, integral pump and motor, air motors. Leiman Bros.

MECHANICAL POWER TRANSMISSION

106 V-Belt Drive Manual — Origin and development of the modern multiple V-belt drive is discussed in 36-pp pocket-size Bulletin 20E8297. Also covers evolution of standards in engineering V-belt drives, tells how to engineer a V-belt drive, provides tables and data, and describes modifications in V-belt drives. Answers to questions relating to basic principles and practices involved in engineering and use of V-belt drives are provided. Allis-Chalmers Mfg. Co.

107 Variable Speed Reducer — Bulletin 20M0156, 12-pp, describes operation principles of an infinitely variable speed transmission with output speeds from zero to ¼ input speed. Standard models are shown with optional variations, typical applications and installation suggestions, dimensions and ratings and description of technical services available. Covers measuring of torque, boosting power or speed, special drives and motors. Revco Inc.

108 Clutches, Clutch-Coupling Units — Catalog 103-C, 8-pp, describes sprag type clutches for over-running, indexing, and backstopping applications, as well as clutch-coupling units. Designed as a quick reference guide to selection of company's products, it includes cutaway photos, cross-section drawings, application suggestions. The Formsprag Co.

INSTRUMENTS, CONTROLS

109 Miniature Instruments — Bulletin 7202, 12-pp, furnishes descriptive and engineering data on a vertical scale indicator, also recorders and controllers, designed to measure and control process variables such as temperature, pressure, flow, and liquid level. Includes full specifications. Minneapolis-Honeywell Regulator Co.

110 Oxygen Analyzer — Sixteen-pp Catalog 55-829-56 explains principle, construction, operation and features of the paramagnetic type Magno-Therm analyzer and the electronic recorder. A chart of major applications lists functions, examples of services, and how and why this analyzer is used. Special models are also described and illustrated. The Hays Corp.

111 For Direct Radiation — Bulletin CA-12, written in non-technical language, tells how to determine proper control system for direct radiation. Illustrated with charts and graphs, this bulletin includes control of steam and hot water and discusses both two-positioning and proportioning control. Barber-Colman Co.

New and revised publications reviewed on these pages offer help on operating and maintenance problems. To order, use the Reader Service Cards page 133.

112 Resistance Temperature Detectors — In 8-pp Publication 3016D are described a line of remote temperature-sensitive elements for use in indicating, recording, controlling and monitoring equipment. Operation, application and construction details of the resistance temperature detectors are presented, along with specifications and ordering data. Instrument Div., Thomas A. Edison, Inc.

113 High Pressure Meters — Bulletin 537, 8-pp, describes company's line of high pressure meters, covering all three types — positive displacement, double-case and the Duo-Rotor meter. Metering principles, dimensions and specifications, engineering data and pressure-drop charts are included. Granberg Corp.

FANS, BLOWERS

114 Heavy Duty Fans — Bulletin DS-348-C, 28-pp, describes a line of heavy duty fans for high velocity air conditioning and industrial process applications. Includes fan selection data, capacity tables, roughing-in-dimensions, as well as photos and drawings showing design features and operation. The Trane Co.

115 Un-plasticized PVC Blowers — Bulletin 102, 20-pp, contains complete technical specifications on company's line of un-plasticized rigid polyvinyl chloride blowers. Performance tables on all models, and chemical resistance charts are included, as well as application information. Industrial Plastic Fabricators Inc.

ELECTRICAL, LIGHTING

116 For Light Load Areas — Bulletin 11B 7895A, 8-pp, describes standardized and package substations for light load areas. Lists material furnished for high and low voltage structures and diagrams optional arrangements for each. Dimensions are included, as well as a dimensional drawing of the entire substation. Allis-Chalmers Mfg. Co.

117 Improved Transformer — Eight-pp Bulletin GED-2727 introduces company's new 15,000-v outdoor current transformer molded of Hy-Bute/60 insulation. Highlights advantages derived from use of this insulation including: smaller size, lighter weight, greater mounting versatility, greater strength, reduced maintenance, safer operation. Information on application, construction, mechanical and thermal ratings, and ratio and phase-angle test data is incorporated in the bulletin. General Electric Co.

118 Liquid-Filled Transformers — Transformers with Chlorextol fireproof insulating liquid for indoor installations are described in Bulletin 61B6043C. Tells how use of these transformers reduces fire hazards and eliminates vaults. Transformers described are available in ratings from 3 through 15,000 kva, 46 kv and below. Allis-Chalmers Mfg. Co.

119 Gear Motors — Eight-pp Bulletin E-2408 describes a new line of gear motors incorporating new NEMA motors and redesigned gearheads. Present examples of types, mountings, enclosures, and ratios available. A cutaway view points out extra features and engineering design details. Also discusses and illustrates simplified maintenance possible. Explains how the unit type construction permits selection of gear motors to meet specific requirements. Reliance Electric & Engineering Co.

120 Flat-Plate Batteries — Exide Powerclad batteries are described in this folder. A cutaway drawing shows details of construction of the positive plate, including the corrosion-resistant Silvium grid. Also shown in detail is the polyethylene insulator which reinforces the Vitrex retainer and forms a continuous wrap around the bottom of the plate. The Electric Storage Battery Co.

121 Capacitor Equipments — Enclosed capacitor equipments for high voltage installations are described in 12-pp Bulletin GEA-2 860D. Covers application of ready-assembled equipments ranging from 600 to 5400 kvar, 2400 v and above, to reduce voltage drop and cut power losses. General Electric Co.

122 Fluorescent Fixtures — Bulletin F-627 features company's industrial-

commercial series of fluorescent lighting fixtures. Describes design features, lists advantages, and includes specifications for a number of models, along with a check list to help in selection of lighting units. Sylvania Electric Products, Inc.

VALVES, PIPING, FITTINGS

123 Air Control Valves — This bulletin is designed as a quick-reference guide to 17 different lines of air-control valves and accessories. Describes each type and includes size and capacity data, along with photos of the valves. Airmatic Valve, Inc.

124 Fly Ash Intake Valves — Bulletin 1-1-55 gives complete information on various stages of development and design of feeding inlet and intake valves for trouble-free operation with pneumatic fly ash conveyors. Describes application for manual and automatic operation and lists important features. United Conveyor Corp.

125 Stainless Tubing, Pipe — Technical Data Card 162A covers welding characteristics of austenitic and ferritic types of stainless steels, and briefly describes welding methods and techniques. Also included is a table indicating electrodes, preheating and post welding heat treatments to be used in joining the stainless steels to each other and to carbon, carbon molybdenum and chromium molybdenum alloy steels by the arc welding method. Tubular Products Div., The Babcock & Wilcox Co.

126 PVC Pipe Fittings, Flanges — This is a comprehensive 12-pp catalog on corrosion resistant pipe fittings and flanges in normal- and high-impact grades, rigid, unplasticized polyvinyl chloride. Shows characteristics, advantages and limitations. Lists operating pressures, temperatures, applications, price comparisons, fabrication advice, installation and supporting recommendations, dimensions and weights. Grinnell Co., Inc.

127 Pipe Strainers — Bulletin 602 gives complete details on company's line of Y-type pipe strainers. Covers design features, dimensions and prices of the eight sizes of cast semi-steel strainers for pressures to 250 lb and the six sizes of carbon moly steel strainers for pressures to 900 lb., temperatures to 900 F. Armstrong Machine Works.

128 Strainers, Air Eliminators — Bulletin OG-326, 8-pp, describes operating and design features of company's line of strainers and air eliminators. Typical installations, dimensions and specifications are included, as well as photos and dimensional drawings. Rockwell Mfg. Co.

129 Plastic Pipe — Technical Bulletin 83, 8-pp, gives information on Pyertex-Omicron PVC rigid type unplasticized pipe. Provides properties and engineering data on this polyvinyl chloride pipe and lists over 200 chemicals it will convey without being attacked. Joseph T. Ryerson & Son, Inc.

130 Expansion Joint Guide — Catalog 153, 24-pp, a complete design guide for application and selection of expansion joints, is filled with engineering data necessary to solution of pipeline expansion problems. Includes a discussion of types of expansion joints available and types of pipeline motion solved by expansion joints. Includes a schematic piping layout illustrating expansion joint applications and principles, as well as full specifications. Flexonics Corp.

131 Data on Expansion Joints — Catalog 53, 24-pp, features comprehensive engineering data on HydroLastic expansion joints. Details of construction and specifications together with directions for ordering and application data for various piping systems are included. Information is presented in the form of tables and numerous photos and drawings are used to illustrate various types. Cook Electric Co.

132 Couplings and Hose — A wide range of reusable and clamp type couplings and hose assemblies for high, medium and low pressure applications is covered in 28-pp Catalog 300. Also described are features of company's Duloc couplings for QW and QWR hose. Photos show how to assemble couplings, and thread information and flow capacity charts are provided, also methods for computing hose length. Anchor Coupling Co., Inc.

. . . Outstanding Among This Month's Catalogs

133 Testing Instruments — Bulletin 19-56, 16-pp, features company's electrical testing instruments, including ohmmeters, ground testers, dielectric test sets, motor rotation tester, cable fault locating equipment, transformer turn ratio test sets, corona test equipment, frequency meters, tachometers, others. Includes photos and descriptions of each type, including chief features, operating ranges, and applications. James G. Biddle Co.

134 Heat-Resistant Cables — Characteristics, capacities and dimensional data on heat-resistant cables are described in 48-pp Bulletin H-463. Typical test results are given for butyl rubber insulation under conditions of heat and extreme moisture. Also included are dimensional tables for power and control cables for direct burial and duct use as well as engineering information on selection and application. Tables, formulas and graphs are included. The Okonite Co.

135 Solvent Detergents — Cleaning uses and abilities of solvent detergents — solvents compounded with surface active agents — are described in this 16-pp booklet. Tells how solvent detergents, used without heat, remove carbonized grease and oil and certain types of paint, and provide temporary rust protection after cleaning. Methods of application are described, including procedures and solution concentration. Application equipment is illustrated and discussed. Oakite Products, Inc.

136 Drafting Techniques — "11 Ways to Save Drafting Time" is the title of this 12-pp pocket-size booklet telling how intermediates can be used to make quick modifications of drawings without changing the original. Covers scissor editing, masking, block-out method, successive additions and pre-printing. Frederick Post Co.

WATER AND WASTE TREATMENT

137 Water Clarification — Technical Reprint T-138, 10-pp, discusses operating factors and selection of chemical treatment for water clarification. Covers theoretical chemical problems of coagulation and actual physical considerations. Selection of the coagulant and various coagulants available is covered, and table comparing characteristics is included. Jar test procedure is described, and tables of data included. Graver Water Conditioning Co.

138 On Iron Removal — Technical Reprint T-144, 8-pp, is a comprehensive article on iron and manganese removal from water supplies. Presents actual engineering layouts of seven different types of iron removal systems. Since iron can be found in many different forms, there is no one solution, article points out. Case histories are discussed, problems analyzed and results presented. Flow sheets are also included. Graver Water Conditioning Co.

139 Industrial Waste Treatment — Technical Paper 64, 6-pp, presents solution to water and waste treatment problems, describing several practical systems for process and waste treatment utilizing controlled volume pumps to meter chemicals and additives. In the area of water treatment, coagulation, clarification, boiler water treating and oxygen scavenging by hydrazine addition are discussed in detail. Paper mill white water recovery systems are among those analyzed. Milton Roy Co.

140 Industrial Waste Treatment — Technical Reprint T-145, 6-pp, discusses the subject of specifying industrial waste treatment. Proper steps to be taken in approaching the problem, methods of treatment and types of equipment used to accomplish given tasks are covered. Graver Water Conditioning Co.

141 Water Conditioners — This bulletin file describes a device designated to eliminate and prevent corrosion and scale formation in boilers and water systems. Explains how it works and gives advantages. Applications are discussed and specifications included. Packard Water Conditioner Div., Inc.

142 How Much for Treatment? — Technical Reprint T-141 is an 8-pp article presenting an economic analysis of conventional and high-rate water treatment plants. Discusses problem of whether to use high-rate or conventional sedimentation equipment and points out merits and disadvantages of each. Photos and engineering drawings, as well as case histories and a graph comparing capacity and cost, included. Graver Water Conditioning Co.

COOLING, HEAT TRANSFER

143 Heat Transfer Data — Bulletin HE 1, 16-pp, contains data on company's line of heat transfer equipment, including a table of heat transfer rates for various duties, tube sheet layout tables and a sample calculating sheet. Also describes a number of heat exchanger types. Photos and drawings illustrate construction details and typical applications. Downington Iron Works, Inc.

144 After Cooler — Bulletin 130, 8-pp, explains the functions of company's Aero after cooler in removing moisture from compressed air and gas. The apparatus is described and illustrated with diagrams and photos. Included also are diagrams and illustrations of applications in liquefaction systems. Niagara Blower Co.

145 Centrifugal Refrigeration — Bulletin DS-399, 52-pp, gives data on

The risk is too great —clean it right

You don't take risks when men, equipment, and lost production time are involved. That's why more and more companies are investigating the methods and firms used in their chemical cleaning. They know it's work for experts.

What are they concerned about?

First, they want to know they are getting the benefits of experience. These benefits include less downtime and more thorough cleaning. Dowell has this experience with over 15 years and 10,000 boilers alone to their credit. In saving downtime, Dowell often cleans equipment while it is in operation.

Next, these companies want to be sure their men and equipment have the greatest possible protection. Dowell excels here, too. For safety is foremost in the Dowell engineer's mind. Thoroughly trained, he uses only the latest safety methods and equipment. He works closely with your safety personnel to establish safest possible working procedures.

Be sure you are getting maximum results with maximum protection in your chemical cleaning.

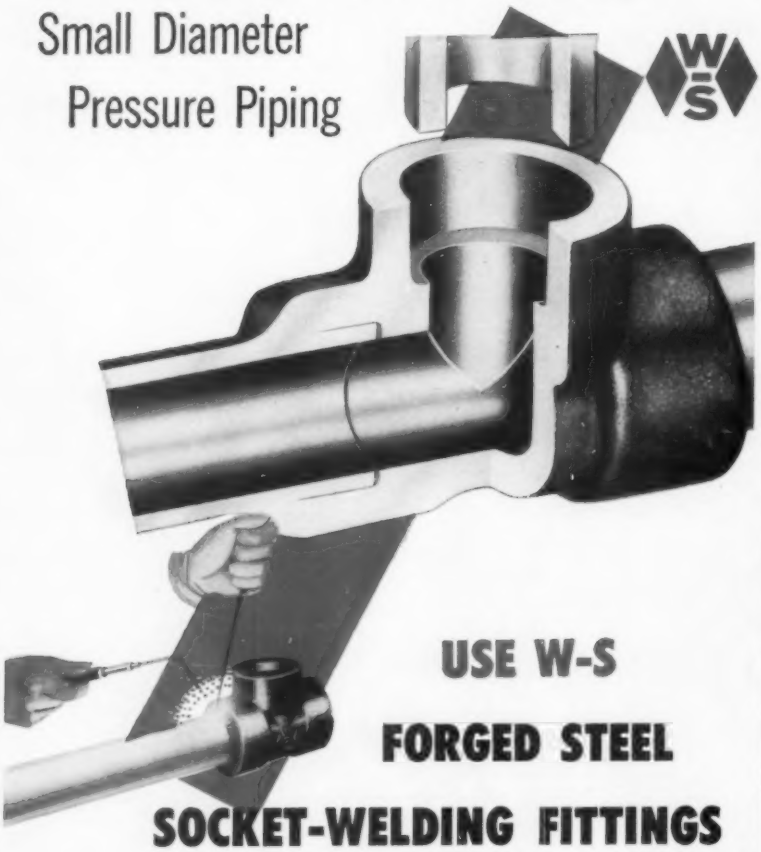
Call the Dowell office near you. Dowell engineers are ready to discuss and help you with your cleaning problems any time, at no obligation. Or write Dowell Incorporated, Tulsa 1, Oklahoma, Dept. D-24.

chemical cleaning service for industry **DOWELL**

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

For more data circle 517 on Post Card

Here's the **EASY WAY TO WELD**
Small Diameter
Pressure Piping



USE W-S
FORGED STEEL
SOCKET-WELDING FITTINGS

In addition to providing high strength and toughness, W-S Forged Steel Socket-Welding Fittings are also easy to install. Deep sockets support and align the pipe for welding . . . eliminating the need for tack welding or special fixtures. No back-up ring is needed either. The fillet-weld is completely outside the pipe. Welding icicles just can't form inside the pipe. The result is a clean, tight welded joint that will readily resist high pressures and the stresses of shock and vibration. What's more, installation costs are lower.

W-S Socket-Welding Fittings are available in sizes ⅛" to 4" for schedule 40, 80, 160 and double-extra heavy pipe in carbon steel, stainless steels and alloy steels.

For complete information on the installation and operation advantages of W-S Forged Steel Socket-Welding Fittings, send today for Bulletin A-3-56.

W-S FITTINGS DIVISION
H. K. PORTER COMPANY, INC.
Roselle, New Jersey

For more data circle 518 on Post Card

company's CenTraVac centrifugal refrigeration equipment, used to provide chilled water for air conditioning and refrigeration systems. Provides full engineering and capacity information on 20 sizes, including six models in the 400 to 600 hp range, and 8 models in the 50 to 300 hp range. Typical installations are shown, as are numerous cut-away views and pictures of component parts. The Trane Co.

146 Refrigerating Machine — Eight-pp Bulletin 1426 describes the Tonrac single-stage hermetic centrifugal refrigerating machine. A cutaway photo illustrates various construction details, including condenser, single-stage compressor, motor and purge system. Photos of a typical installation are included, and related refrigerating and air conditioning equipment shown. American Blower Corp.

147 For Cooling, Condensing — Various types of units used to build cooling and condensing systems for process fluids are described and illustrated in 24-pp Catalog HT-23. Includes data on use of sections in refineries, by-product plants, and in gas, chemical, steam or diesel power, heat treating and wood preserving plants. Among subjects covered are design features, physical characteristics, and types of installation. Thermal design of a cooler or condenser, calculations for an evaporative cooler, fittings, water distribution accessories. Heat Transfer Div., National-U. S. Radiator Corp.

You'll save time in ordering bulletins by using the Reader Service Cards on page 133. Of course we honor letterhead requests—but it takes us somewhat longer to handle them.

148 Cooling Tower — Construction and operational details of an induced draft cooling tower are described in Bulletin CT-56-1. Provides a three-dimensional drawing of a tower cell, also perspective drawings of major equipment features, including water-mixer drift eliminators, cone spray nozzles, bracing and anchoring system, framing. Foster Wheeler Corp.

149 On Heat Exchanger Design — Bulletin PE-33 is a 16-pp design manual for Pyrex brand modular glass shell and tube heat exchangers. Edge-indexed for convenience, manual offers help in choosing the right module for a heat exchange system. Ten engineering drawings show how company's heat exchanger modules can be installed. Engineering data for determining capacity requirements of the 50 sq-ft and 13½ sq-ft capacity heat exchanger systems include charts and information on fluid constants, friction losses, surface area calculations and thermal gradients. Corning Glass Works.

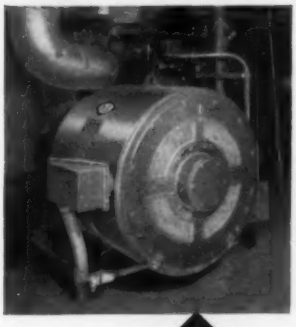
OTHER EQUIPMENT

150 Leather Packings — Covering the design and application of hydraulic and pneumatic leather packings, this 58-pp handbook tells what a packing is and how it is used, and discusses advantages of mechanical leather packings. Selection and processing of leather for packings is described, and dimensional and application data for cup, flange, "U", V packings, and

Furnishing Major Auxiliary Drive Power at Indiana-Kentucky Electric Corporation's Clifty Creek Plant

Three of eighteen Allis-Chalmers 2500-hp, 4000-volt, 3580-rpm two-pole motors driving boiler feed pumps at Clifty Creek.

Rooftop installation of Allis-Chalmers 1500-hp, 4000-volt, 1185-rpm weather-protected motors. This is one of twelve Allis-Chalmers motors giving dependable service driving forced-draft fans at this modern new plant.



Allis-Chalmers 250-hp flange-mounted motor driving plant air compressor. This unusually economical mounting method for such a large motor can be attributed to Allis-Chalmers experience in motor applications throughout the electric power industry.

A wide variety of Allis-Chalmers motors furnish most of the major auxiliary drive power at Clifty Creek Plant near Madison, Indiana. Allis-Chalmers motors are driving plant air compressors, coal handling equipment, forced-draft fans, boiler feed pumps and many other pumps.

The Allis-Chalmers motors at this Indiana-Kentucky Electric Corporation installation are just a few of the complete line of motors Allis-Chalmers builds for power plant service. Contact the Allis-Chalmers district office in your area, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin, for complete information.

A-4956

Now, You Can Get Even Greater Winding Protection with SILCO-FLEX

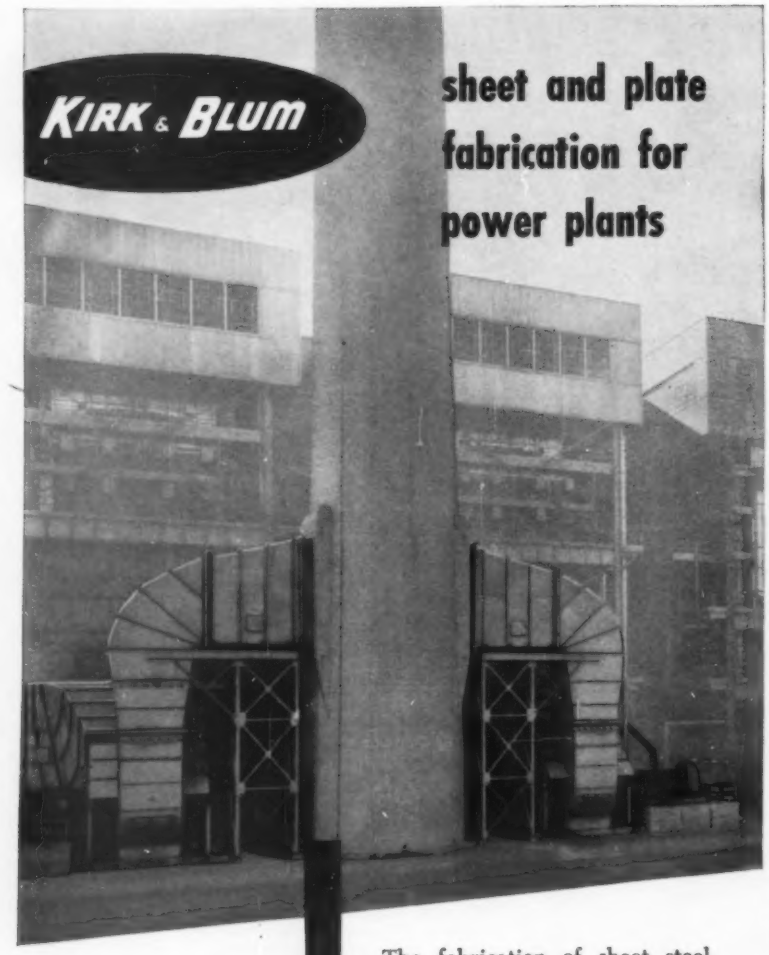
all-silicone-rubber motor insulation. Available only on Allis-Chalmers motors — in many of the larger sizes. Ask your A-C representative for the facts about this revolutionary new insulation system.

Silco-Flex is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

For more data circle 519 on Post Card



- breechings
- stacks
- air & gas ducts
- casings
- louvers
- bins & hoppers
- insulation jacketing
- control panels & desks

The fabrication of sheet steel and plate to exacting specifications has been a specialty of Kirk & Blum for 50 years. Exceptional experience and complete facilities for fabricating carbon steel, stainless, aluminum, monel and other alloys up to ½" thickness.

Send prints for prompt quotation or write for your copy of the latest Kirk & Blum Sheet and Plate Fabrication Booklet.

Whatever your requirements in sheet and plate fabrication . . . call on KIRK & BLUM.

THE KIRK & BLUM MFG. CO.
3230 Forrer Street, Cincinnati 9, Ohio

For more data circle 520 on Post Card

leather gaskets, washers, and diaphragms provided. Facts on surface finish of cylinders and shafts, hydraulic fluids, are included, along with packing hints, a glossary of terms, and temperature conversion charts. J. E. Rhoads & Sons.

151 Metal Protective Paints — This 8-pp catalog describes advantages and technical features of company's anti-corrosive paints for the protection of metal surfaces. A selection guide is included, along with application information. Subox, Inc.

152 Clay Conduit Structures — Bulletin 56, 20-pp, describes clay conduit structures for underground steam, hot water and process piping. Features various types produced by company, and illustrates applications. Engineering and specifications data is included, along with photos and drawings. Heat Transmission Conduit Co.

153 Repairing Cast Iron Parts — Illustrated bulletin outlines information on the welding of cast iron with Ni-Rod and Ni-Rod 55. Nine graphic case histories show welding electrodes in action. The International Nickel Co., Inc.

154 Coal Dust Handling — Bulletin 551-D, on control of dust from coal handling operations, discusses use of local exhaust ventilation and cloth-tube type dust collectors. Four illustrated case histories are presented. Also provided are diagrams of some materials handling systems and how dust control is incorporated in them. Wheelabrator Corp.

155 Pipe Insulation — This 12-pp booklet gives information on Thermobestos pipe and block insulation for hot outdoor piping and process equipment operating at service temperatures to 1200 F. Explains why this hydrous calcium silicate insulation has exceptional strength and extreme lightness; is chemically stable and non-flammable; has low conductivity and is not damaged by water. Section of booklet is devoted to prefabrication of fittings, physical and thermal properties and tables of sizes and thicknesses. Heat transmission tables included. Johns-Manville.

156 For Standby Power — Bulletin 125 illustrates emergency standby power applications of diesel generator sets, diesel and dual-fuel engines. Information on design features and output data are explained. Murphy Diesel Co.

157 Cleanable Filter — An all-metal, edge-type, liquid filter, which stops micronic particles and is cleanable without interrupting flow, is described in Catalog SAK-057, 8 pp. This filter is designed for lube, fuel and hydraulic liquids on diesels and special machinery. Bulletin tells how this small filter with high flow rates affords lower operating and installation costs. Diagrams show operating principles, construction. The Cuno Engineering Corp.

158 Car Pullers — Bulletin L-6, 10-pp, illustrates and describes company's line of car pullers. Shows capstan type car pullers for moving cars a short distance using manila rope. Three style of drum car pullers for heavy duty car moving, shuttle work or for servicing exceptionally large areas are also listed, as well as barge movers. Clyde Iron Works, Inc.

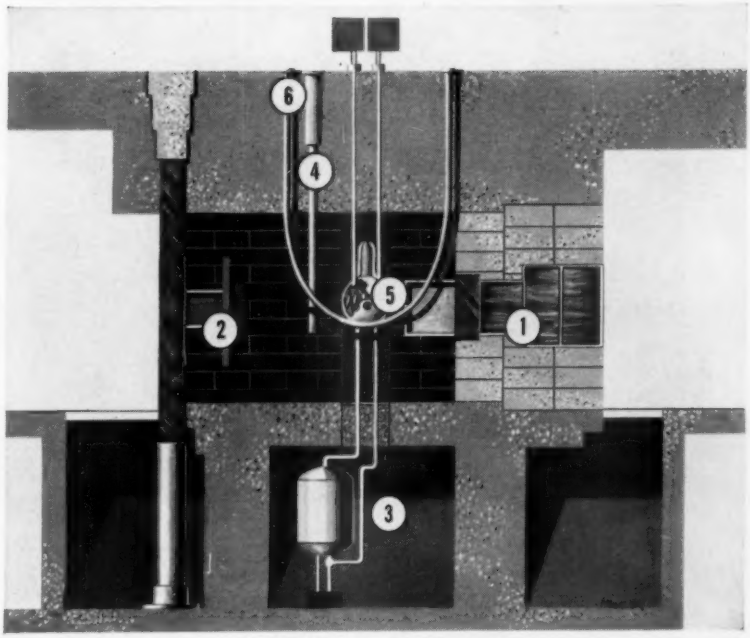
159 Pipe Cutters — This folder describes application of manually operated cutters to field cutting of asbestos-cement pipe. Contains data and illustrations on a large cutter which cuts all sizes to 20 in.

NUCLEAR NEWS FROM ATOMICS INTERNATIONAL

Nuclear Reactor for Cancer and Other Medical Research

This new reactor utilizes the proven homogeneous solution design based on the SUPO unit at Los Alamos—modified and adapted to the special needs of cancer and other medical research and therapy. To be built by ATOMICS INTERNATIONAL for a prominent southern California university Medical Center, the reactor will provide a variety of radiological facilities—primarily high purity neutron and gamma beams with controlled exposure times in each. The thermal neutron flux at the central exposure tube is 1.7×10^{12} n/cm²-sec. at a power of 50 Kw.

Gas handling system assembly for nuclear research reactor. This component, developed by Atomics International, contains facilities for circulating the reactor atmosphere, recombining the radiolytic gases, condensing the water vapor and returning water to the reactor core, in a closed cycle operation. Additionally, the tank at top which contains fission product gases, provides an intense source of neutron-free gamma radiation.



Medical Reactor Test Facilities

1. Gamma and Fast Neutron Facility—Gamma intensities of 1.3 reb/min/Kw and fast neutron intensities of 4 reb/min/Kw are available.
2. Thermal Neutron Facility—Provides neutron flux of 3.8×10^7 n/cm²-sec. per kilowatt.
3. Gamma Radiation Area—Activity of the fission gases provides a radiation source in the gas handling equipment room.
4. Multiple Specimen Irradiation Tube—One or more in the reflector. Each accommodates 16 samples.
5. Central Exposure Tube—A 1-inch internal diameter tube through the center of the core permits access to maximum neutron flux.
6. Pneumatic Tubes—Tangential to core. Also (not shown) are Beam Tubes—Radial to core, or through reflector tangential to the core.

One Configuration of the thermal neutron facility provides a neutron flux of 3.8×10^7 n/cm²-sec/Kw with a gamma ray intensity of only 0.1 reb/min./Kw (reb—roentgen equivalent biological). The fuel is Uranium enriched in the U^{235} isotope in the form of UO_2SO_4 dissolved in light water. This fuel-moderator solution, cooled by chilled recirculated water, is contained in a stainless steel core tank surrounded by a graphite reflector and dense concrete shield. Radiolytic and fission gases produced in operation are handled in a closed-cycle, water recombination and return system, which eliminates any discharge of radioactive core effluents and permits the re-utilization of materials.

Atomics International is a major reactor builder—experienced in the design, construction and operation of nuclear reactors for research and the production of power. If you are interested in any phase of our activities, ATOMICS INTERNATIONAL is staffed and equipped to help you. Please write: Applications Engineering Service, Dept. PE-N1, ATOMICS INTERNATIONAL, P.O. Box 309, Canoga Park, California. Cable address: ATOMICS.

ATOMICS INTERNATIONAL
A DIVISION OF NORTH AMERICAN AVIATION INC.
PIONEERS IN THE CREATIVE USE OF THE ATOM

For more data circle 521 on Post Card

if

you have any of these troubles:

- scale, corrosion, or foaming in your **boiler operation**
- rust and corrosion in your **steam and condensate return lines**
- scale, corrosion, or algae growth in your **cooling or condenser water system**
- corrosion or scale in your **hot or cold water tank and lines**
- rust and corrosion in your **brine or sweet water system**
- scaled up **pumps, water jackets, compressors, coils, lines, or equipment**
- sludge and moisture in your **fuel oil supply**
- soot deposits in your **furnace combustion areas**

then...

let WESTERN prove to you how a specific treatment applied to your specific problem can restore and maintain efficiency and economy in your use of water, steam, and fuel. Mail the coupon today for full information.

65 Years Experience in the Chemical Treatment of Water.

Chemical Treatment for Water Steam and Fuel

WESTERN CHEMICAL COMPANY

717 Washington Street Kansas City 5, Missouri

MAIL THIS COUPON TODAY

Please send information about

Name

Firm

Address

City Zone State

For more data circle 522 on Post Card

nominal pipe size and a junior model for pressure-pipe and flue-pipe applications. Specifications are included, as well as photos illustrating features. Pilot Mfg. Co.

160 Motor Graders — Design, engineering, construction and performance of company's 50-hp Model D motor graders is described in 16-pp Catalog MS-459. Cutaways, photos of components, combustion graphs, and other illustrations point out features of both gasoline and diesel engine graders. Attachments and accessories are shown, and specifications included. Construction Machinery Div., Allis-Chalmers Mfg. Co.

161 Quick-Opening Door — Bulletin 2030 describes the p-k Lever-Lock quick opening door for heat exchangers, sterilizers and autoclaves. Use on horizontal and vertical equipment, with both manual and pneumatic control, is illustrated, and important design and operation features are described. The Patterson-Kelley Co., Inc.

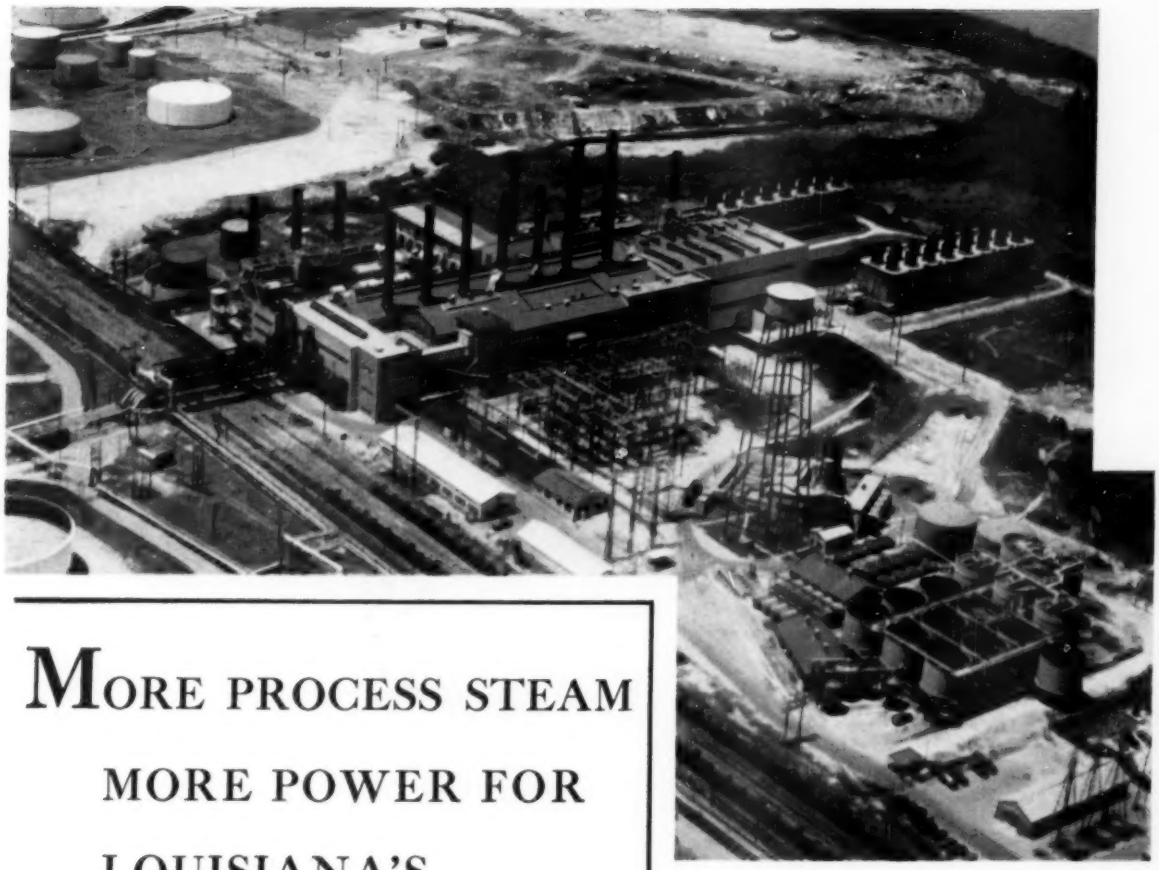
Bulletins reviewed here are offered primarily for qualified power engineers. Manufacturers may withhold literature from persons who do not state their job title and company. Some manufacturers also prefer not to send literature to those in foreign countries in which they have no sales representatives.

162 Vibration Mountings — Rubber-in-shear vibration mountings are described in Catalog RS-55. Covers such construction features as "floating action" that provides flexibility and isolation. Various types of vibration mountings with load capacities from 40 to 10,000 lb are described, as are non-walking base-plates. T. R. Finn & Co.

163 Molybdenum Silicide Data — Two companion publications on molybdenum silicides are 8-pp Bulletin Cdb-6 on refractory molybdenum silicides, and Bulletin CH-23 on the fabrication of molybdenum disilicide parts. In the former, information on various molybdenum silicides is consolidated from 52 sources. Treats preparation, applications, and properties of this new class of refractory compounds. In addition, multisilicide systems are covered. In the bulletin on fabrication, the techniques used to make molybdenum disilicide parts are detailed. Climax Molybdenum Co.

164 Inter-Floor Transportation — Construction features and applications of company's manlift for fast inter-floor transportation are described in Bulletin 07B68B. Includes diagrams showing safety measures to be considered with each installation. This manlift is also designed to carry bags and other packed materials. Allis-Chalmers Mfg. Co.

165 Solvent, Air Recovery — A survey of solvent and air recovery by means of activated charcoal is given in Technical Bulletin W-356, 10-pp. Covers theory and history of solvent and air recovery, and details advantages and circumstances under which such systems may prove advisable from standpoints of economy, safety, improved working conditions, pollution elimination. Also treats estimated costs, efficiencies. Barneby-Cheney Co.



MORE PROCESS STEAM
MORE POWER FOR LOUISIANA'S INDUSTRIES

Louisiana Station, situated north of Baton Rouge, was the first large plant designed to utilize oil refinery residues for as much as one-third of its total fuel requirements.

Louisiana Station of Gulf States Utilities Company was designed and built by Stone & Webster Engineering Corporation in 1930. With an initial capacity of 1,500,000 pounds of steam per hour and 45,000 kilowatts, it was one of the first utility plants to generate electric power as a by-product of the large scale supply of process steam for industry.

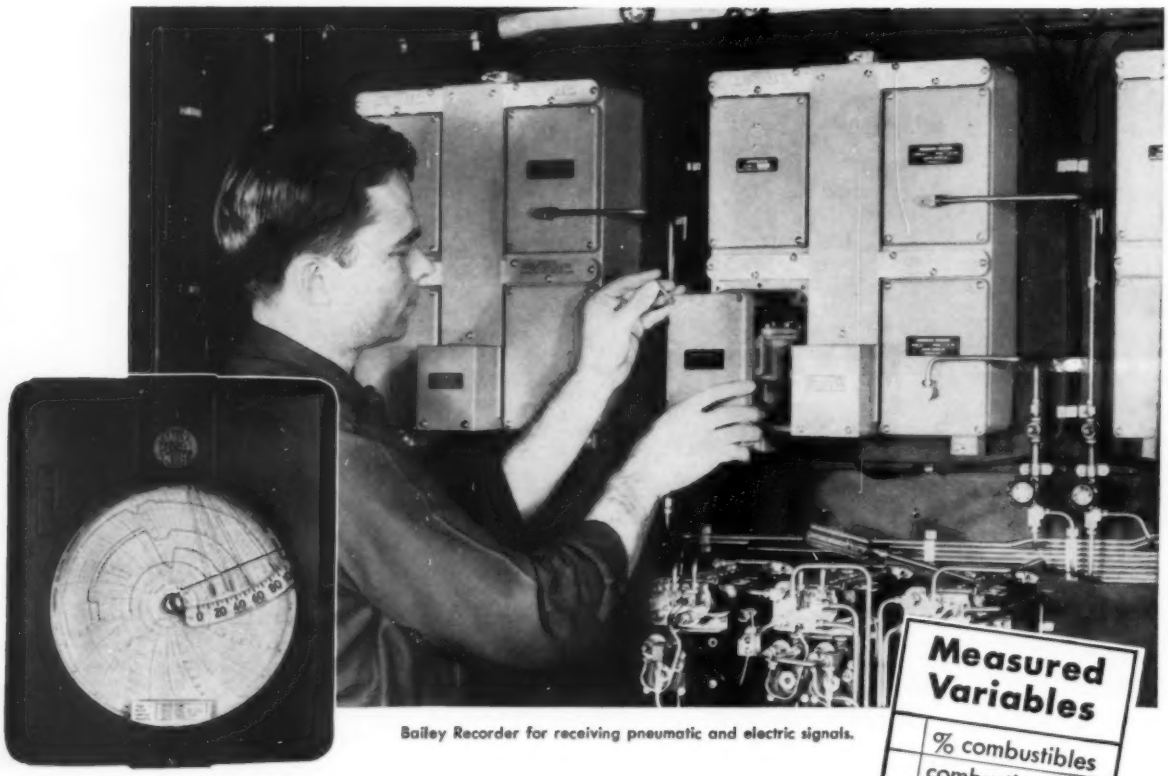
To supply the additional requirements of the oil refinery which was its original customer, as well as those of new industries attracted to the area which utilized both process steam and electric power, Gulf States through the years has engaged the Corporation to design and build new units. The most recent addition, just completed, brings the total capacity of the plant to about 6,750,000 pounds of steam per hour and 406,000 kilowatts.

If you have a problem of design or construction, our broad experience in these and related fields may help you solve it. Write or call us for complete information on our services.

STONE & WEBSTER ENGINEERING CORPORATION

AFFILIATED WITH E. B. BADGER & SONS LIMITED (LONDON)

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto



Bailey Recorder for receiving pneumatic and electric signals.

Pick any four, plug in, and record

Here is a receiver recorder, custom-built *by you* to meet your needs, no matter how changeable, how complex. On a single chart you can record any four measured variables—and interchangeable receivers permit new combinations almost at will.

Individual plug-in pneumatic or electronic receivers—and corresponding integrators—are interchangeable in the four identical frame slots. You can select any combination; even including two receivers and their two integrators.

Think what this can mean to you! Parts inventories are minimized; re-use of components keeps instrumentation costs economically low when cycle changes are frequent—and you can even tie in with your existing transmitters.

Ask for Product Specification E12-5.

Measured Variables

- % combustibles
- combustion
- conductivity
- density
- differential
- draft
- flow
- liquid level
- % oxygen
- pH
- position
- pressure
- ratio
- smoke density
- specific gravity
- speed
- temperature
- vacuum

P58-1

ONLY BAILEY OFFERS ALL THESE ADVANTAGES IN A SINGLE RECORDER

- Pre-calibrated plug-in receiver units
- Up to four pneumatic or electronic receivers —or two receivers and two integrators
- Any four variables on one chart—easily read and interpreted
- A full year's ink supply at one loading
- Faster ordering—from stock
- Minimum inventory of parts
- Minimum instrument investment for process cycle expansion or alteration

BAILEY METER COMPANY

1040 IVANHOE ROAD

CLEVELAND 10, OHIO

Controls for Power and Process

BAILEY METERS

Controls for

TEMPERATURE
PRESSURE
GAS ANALYSIS
FLOW · LEVEL
RATIO · DENSITY

For more data circle 524 on Post Card

NO Reducing Valve Needed

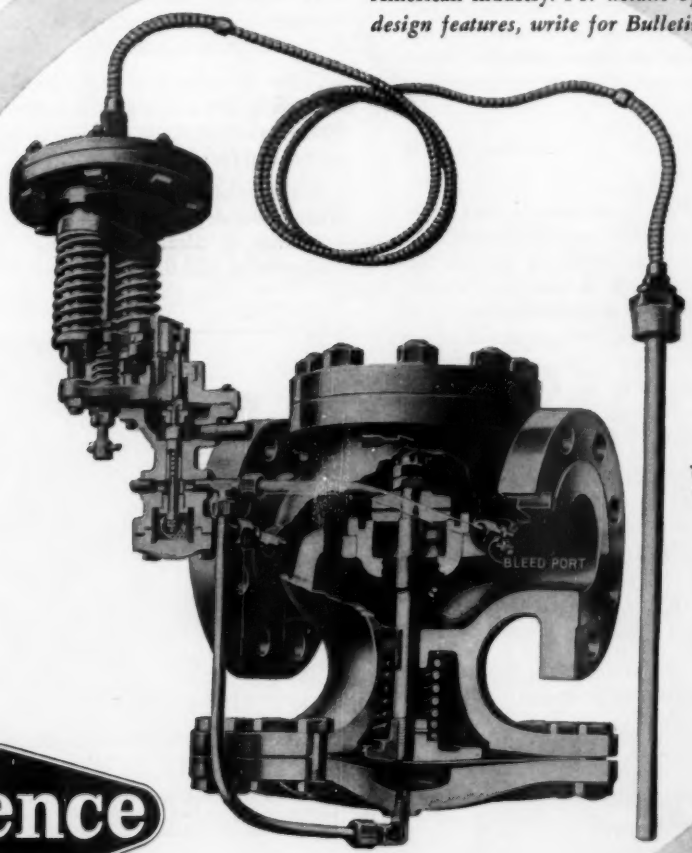
Here's real economy in temperature control.

Because Spence Temperature Regulators are designed to limit heater steam pressures to an adjustable maximum, the need for a separate reducing valve is completely eliminated.

The Spence Regulator takes steam directly from the boiler or high pressure line, reduces the pressure and regulates the flow as required to maintain a constant temperature output from the heater.

This means one relatively small combination pressure and temperature regulator replaces a reducing valve of the same size and a larger temperature regulator. Practically the entire cost of the large separate temperature regulator is saved. And, the total saving would also include the cost of a 3-valve by-pass along with all labor for installation.

This design feature is just one of the reasons for the thousands of Spence installations throughout American industry. *For details of other important design features, write for Bulletin T50.*



SPENCE
TYPE ET150
Temperature
Regulator

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

SS-139

For more data circle 525 on Post Card

NEW SUPERCHARGED

developed by Foster Wheeler

offers FIVE IMPORTANT

FOSTER WHEELER has developed a new supercharged boiler of far-reaching significance to the power industry.

In the supercharged cycle, diagrammed schematically on the facing page, high pressure combustion gases leaving the boiler are used to drive a gas turbine which, in turn, compresses combustion air for the boiler and drives an auxiliary generator. Spent gases from the turbine pass through an economizer and thence to the stack.

The following advantages are inherent in this supercharged boiler cycle.

1. There is a marked increase in overall plant economy. When utilizing maximum gas turbine operating temperatures, net power developed by the gas turbine can run as high as 15% of total plant output, with an overall gain of 10% in cycle economy. Even when operating at lower exit-gas temperatures, where the gas turbine is used only to drive the compressor, cycle economy is increased by the amount of power that would otherwise be required for operating the fans of a conventional boiler.

2. The supercharged boiler permits a rather astounding reduction in size and weight, due to much higher heat absorption rates. A supercharged boiler may weigh from ½ to ¼ as much as a conventional boiler of equivalent capacity. This, of course, permits a substantial saving in first cost—as much as 25% or more, depending on cycle conditions.

3. Start-up time is extremely short compared to that of a conventional steam generator.

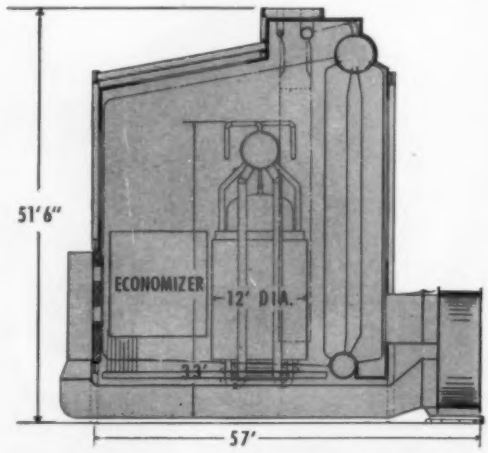
4. The supercharged boiler responds much more quickly to load changes.

5. Boilers can be completely shop fabricated and shipped ready to install.

To obtain the design symmetry essential for this pressurized firing service, the boiler drum is mounted separately above the boiler furnace—connected to it by external risers and downcomers. The furnace is fully enclosed with waterwall surface and a metal baffle separates the furnace tubes from the convection section. Superheated pancake coils are located in the base of the firing chamber.

Foster Wheeler has built three of these supercharged boilers and a fourth is now under construction. At present, units can be furnished for natural gas or light fuel firing.

For complete information on this important Foster Wheeler development, send for a copy of the December issue of "Heat Engineering". *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*



Comparison of physical dimensions of a conventional boiler (gray) and supercharged boiler (red). Both units are designed to furnish steam at 1200 psi, 950F for a 43,000 kw station.

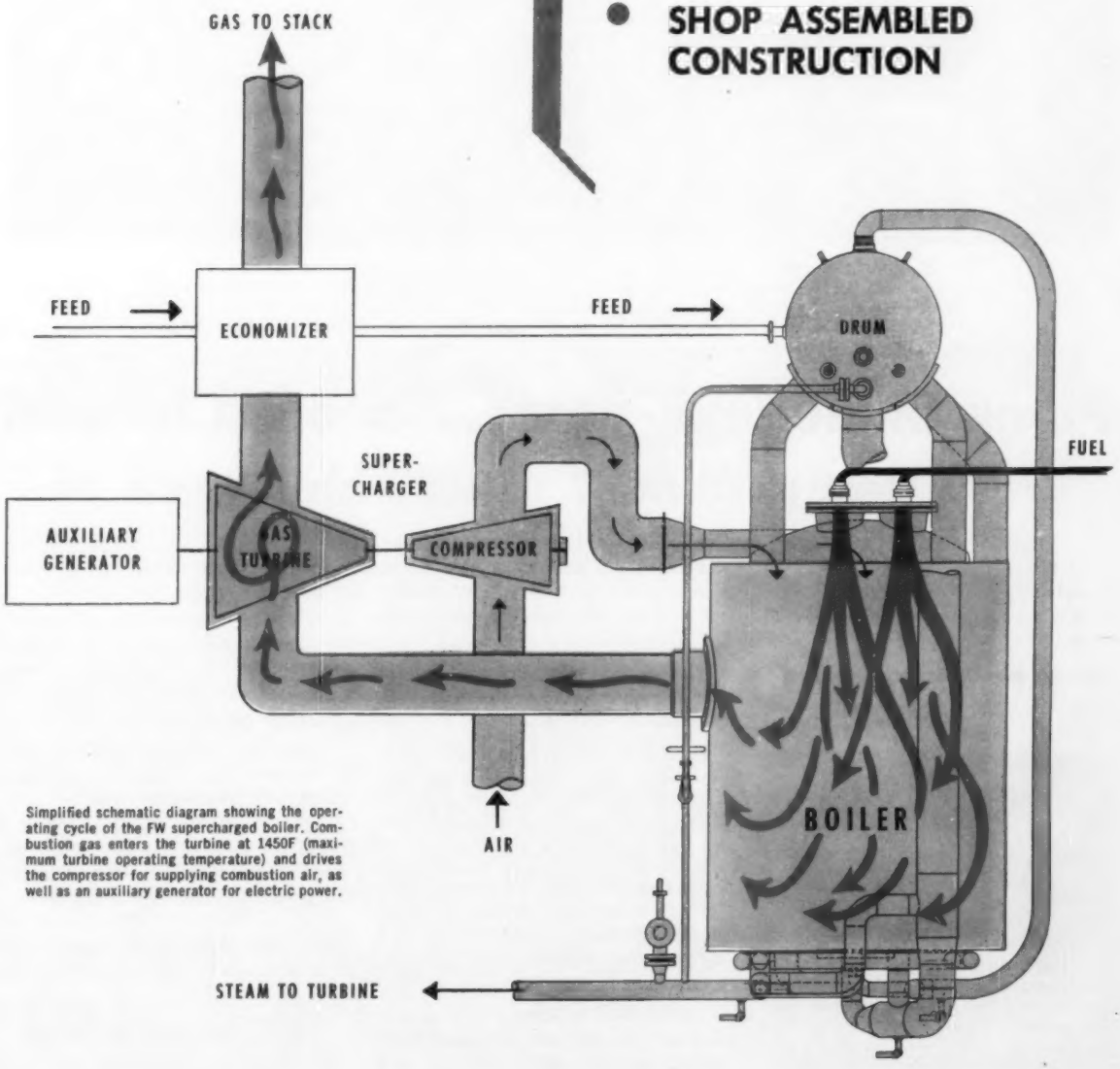
FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

BOILER

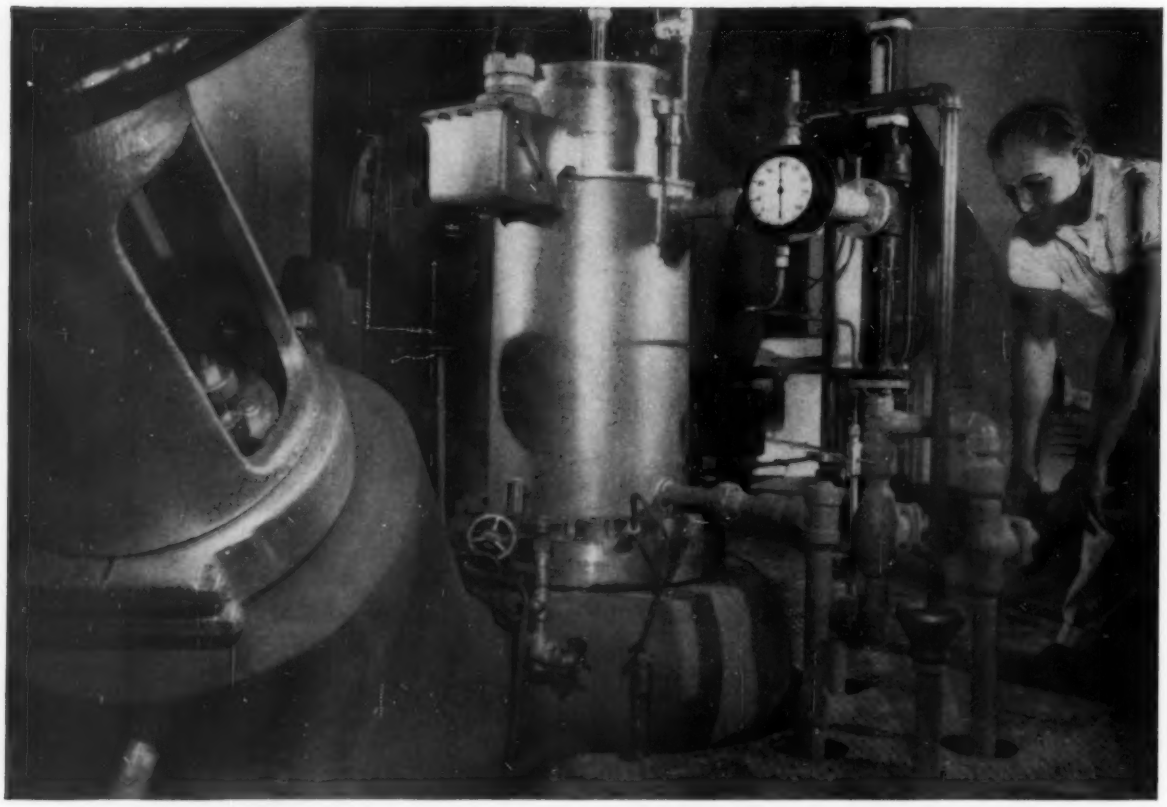
ADVANTAGES...

- HIGH OVERALL ECONOMY
- DRASTIC REDUCTION IN SIZE AND WEIGHT
- SHORT STARTING TIME
- QUICK LOAD RESPONSE
- SHOP ASSEMBLED CONSTRUCTION



Simplified schematic diagram showing the operating cycle of the FW supercharged boiler. Combustion gas enters the turbine at 1450F (maximum turbine operating temperature) and drives the compressor for supplying combustion air, as well as an auxiliary generator for electric power.

For more data circle 526 on Post Card



This "canned" motor-pump...comprising a pressure-tight cell that houses stator and rotor (each in sealed "cans") plus impeller...circulates 4700 gpm of 605°F water at 1725 psi continuously in a closed loop system. Units can be built for pumping 5 to 17,000 gpm at pressures up to 2500 psi at 650°F; units for liquid metal, to 1000°F. A development of Atomic Power Div., Westinghouse Electric Corp.

Pump made leak-proof...needed Inconel

For steam plants *today*...atomic plants *tomorrow*

THIS IS a "canned" motor-pump. It's completely sealed to circulate coolant in a closed system for as long as 20 years!

Without maintenance or leakage

Zero leakage is an essential for nuclear reactors, because their coolants absorb neutrons and become radioactive. Even the *smallest* leak could spell disaster.

The canned pump may also prove a great advance for other high-temperature, high-pressure uses.

Basic to its success is Inconel* nickel-chromium alloy. Inconel helped the designers lick the induction-motor-operating problem caused by two metallic walls between stator and rotor.

Making the walls of Inconel — *thin* Inconel — gives them high electrical resistivity. Minimizes current loss. And there's no interference with magnetic fields.

In addition to being non-magnetic, Inconel nickel-chromium alloy provides high strength at 1000°F and above. It resists corrosive attack and stress-corrosion cracking, too.

The canned motor-pump is but one of many examples of why you'll find Inco Nickel Alloys in tomorrow's nuclear-energy equipment . . . and in today's power plants.

Right now, consider *your own* particular problem. Perhaps an Inco Nickel Alloy will provide the exact physical, chemical and electrical properties you need. Let us help you find out. Write Inco's Technical Service Section for suggestions. There's no obligation.

*Registered trademark

Inconel liner seals stator from coolant. Another seals rotor. Liquid being pumped can flow between. No external shaft seals. No packing problem. Developed by Westinghouse to meet a need on atomic powered U.S.S. *Nautilus*.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

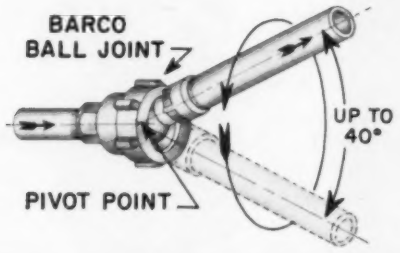
INCO TRADE MARK NICKEL ALLOYS

For more data circle 527 on Post Card

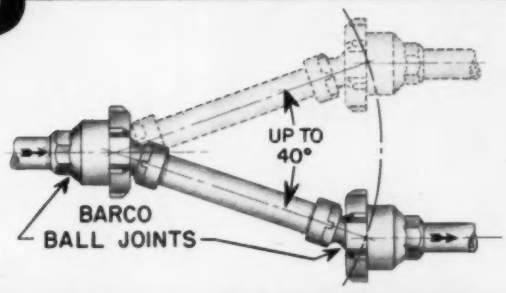
Barco Flexible Ball Joints

for solving piping problems { MOVEMENT • ALIGNMENT • EXPANSION
CONTRACTION • VIBRATION • SHOCK

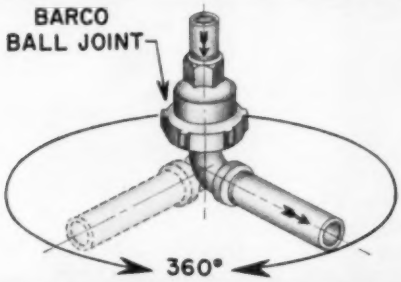
BARCO



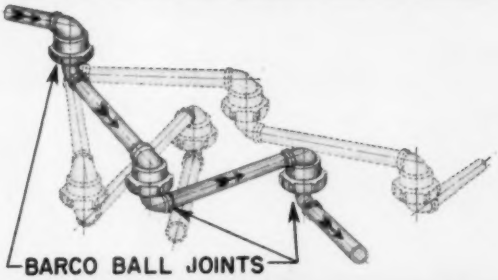
ONE JOINT—Provides for angular motion or positioning of piping in any plane. (Also see below.)



TWO JOINTS—This arrangement provides for piping alignment or simple flexible connection.



ONE JOINT—Allows for full 360° swivel or swing motion, in addition to angular movement shown above.



THREE (OR MORE) JOINTS—For complete flexibility. Any angle! Any radius! Any plane! Many arrangements possible.

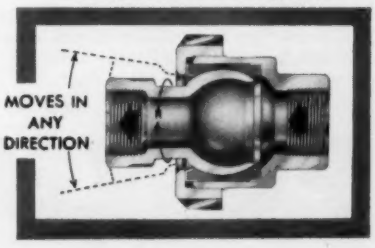
In Power, Heating, and Process Piping

THE four basic principles of motion illustrated above make the BARCO Flexible Ball Joint one of the most useful, most versatile fittings ever developed for application to piping conveying steam, water, air, chemicals, oil, and countless other fluids. *One joint often does the work of two or more ordinary swivel joints, because it moves in any direction!*

Metal pipe made flexible with Barco Flexible Ball Joints is practically indestructible. Long range planning calls for the permanence of this type of construction—*for freedom from maintenance and replacement, and SAFETY!*

There are many applications for Barco Flexible Ball Joints in industry: (1) To permit movement, (2) To accommodate expansion and contraction, (3) To provide for alignment, (4) To insulate against vibration and shock. For piping up to 12". Wide choice of styles and materials. *Let us give you the complete story.*

GET THE FACTS—New Catalog 2158 is an interesting, illustrated handbook on the application of Barco Flexible Ball Joints. Send for your copy NOW.



BARCO *Manufacturing Co.*

547E Hough Street • **Barrington, Illinois**

THE ONLY TRULY COMPLETE LINE OF FLEXIBLE BALL, SWIVEL, SWING, AND REVOLVING JOINTS

For more data circle 528 on Post Card

Powell Lubricated Plug Valves

Fig. 3059 (Sectional) A.S.A. 300-pound Steel Lubricated Plug Valve

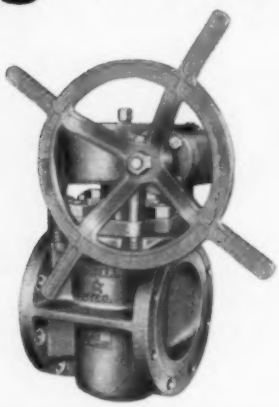


FIG. 1559G—150-pound Steel Lubricated Plug Valve. Gear operated

FIG. 2200—175-pound W.O.G. Semi-Steel Lubricated Plug Valve

PERFORMANCE PV VERIFIED

Powell Lubricated Plug Valves maintain the 110-year tradition of quality and precision. Only the finest available materials are used. And painstaking quality control is rigidly enforced through each and every step of manufacture.

Valve users who want one source of supply for lubricated plug as well as all types of bronze, iron, steel and corrosion-resistant valves will want full details on Powell Lubricated Plug Valves.

For example, features include quick and positive operation—just a quarter-turn to open or close. Lubricant grooves surrounding each port provide a positive seal when the valve is closed. In an open position, seating surfaces are not exposed. Available in Steel and Semi-Steel through distributors in principal cities.

For full details, write for the new PV-4 Catalog on Powell Lubricated Plug Valves. Just fill out the coupon and mail. Of course there's no charge, no obligation.

THE WM. POWELL COMPANY
2525 Spring Grove Ave.
Cincinnati 22, Ohio

Gentlemen:

Please send me a copy of your PV-4 Catalog on Powell Lubricated Plug Valves. It is understood that there is no cost, no obligation.

*name*_____

*title*_____

*company*_____

*city*_____

*zone*_____ *state*_____

The source of supply for all valve needs!

POWELL VALVES...110th YEAR

BRONZE, IRON, STEEL AND CORROSION RESISTANT VALVES.

For more data circle 529 on Post Card

Hall Industrial Water Report

VOLUME 4 APRIL 1956 NUMBER 2

Corrosion—a Plague on All Our Houses

—presents problems as varied as industry, for all industry uses water in some way and all water causes corrosion to some extent. Thirty years of experience in thousands of individual plants enables Hall Laboratories to apply to current problems the most practical techniques for control of corrosion, many of them developed by Hall research and engineering.

Condensate System Saved

On his first visit to a new client, a hospital in Virginia, Hall engineer C. F. Raines encountered corrosion of the black iron condensate system so "terrible" that two men were kept constantly busy just replacing fittings and piping.

Both pitting and etching of the steel were occurring, suggesting that both dissolved oxygen and carbon dioxide were factors in the corrosion. However, the oxygen was not readily accounted for.

Raines examined the feedwater heater and found there was no way for the steam from the deaerating section to pass to the vent condenser. A tee had been installed in the line to take care of this, but instead had been used for a condensate line from the laundry. By proper rearrangement of connections, adequate venting was obtained as had originally been intended.

Additional changes included feeding 1 ppm. of Hagafilm® to the boilers to inhibit return line corrosion, and Santosite to react with residual oxygen not removed in the feedwater heater. Condensate line corrosion became negligible. Instead of replacing the entire condensate system at a cost of several thousand dollars, the plant now protects the system chemically at a cost of 17 cents a day.

Gasket "Corrosion" Problem Quickly Solved

Attack of boiler handhole gaskets at the pressure points of the locking clamps—center top and center bottom—on the sealing surfaces was experienced at a plant in West Virginia serviced by Hall engineer Wm. J. Reese.

At first it was thought that a highly-concentrated solution of caustic had dissolved the asbestos packing.

This possibility was rejected when it was concluded, after careful examination, that the gaskets had been distorted due to excessive pressure applied to the extremities of the minor axis in order to prevent leakage at the ends of the major axes. Subsequent investigation revealed the machined surfaces of the seats did not overlap properly at the ends of the minor axes, and the high points coincided with the areas of attack on the damaged gaskets. Refinishing the gasket seats eliminated the problem.

Bacterial Growths Get the Air

Severe corrosion under rusty deposits in an ammonia condenser prompted a food processing plant in Ohio to call on Hall Laboratories for help. Suspecting iron-fixing bacteria to be responsible for the hydrous ferric oxide deposits, Sales Engineer J. M. Harvey sent samples of water and a sample of wet deposit to Pittsburgh for investigation.

Bacteriological examination showed both iron-fixing and sulphur bacteria in the well water. Chemical examination showed the water to be high in bicarbonate hardness, with approximately 2 ppm. of iron and manganese in solution. Chlorination of the water was needed to kill the living organisms, but this would oxidize the iron and manganese and cause them to deposit, even though the iron-fixing bacteria which had been causing this were eliminated. Harvey met this dilemma by recommending stabilization of the calcium carbonate, iron, and manganese by continuous feed of threshold amounts of Calgon directly to the bottom of the well, followed by intermittent addition of hypochlorite to the discharge side of the well pump.

But this plant had everything. Now a different problem developed with an accumulation of slime in the condensers. In a new sample of wet deposit, Hall Laboratories found sulfate-reducing bacteria. Since these peculiar "bugs" thrive only in the absence of oxygen, continuous aeration of the well water was recommended to supplement the intermittent chlorination.

Operating experience has proved that aeration has been decidedly beneficial. There have been no condenser outages for cleaning, whereas formerly cleaning was necessary several times each summer.

These Whistles a Bargain, Sir!

In a Michigan plant the original soot blowing system lacked the whistles normally installed. When the steam valve was shut off after soot blowing, the vacuum produced drew gases from the ash pit through the drain into the piping. Severe corrosion resulted. Correction involved installation of the whistles to prevent vacuum by acting as vents.

Ben Franklin's advice to consider alternatives before buying a whistle lest disappointment prove payment too dear for the choice could thus be answered, "*These* whistles were a bargain, Mr. Franklin."

Industrial Water Problems Require Special Handling

There are no "stock answers" to industrial water problems. For information write, wire or call Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

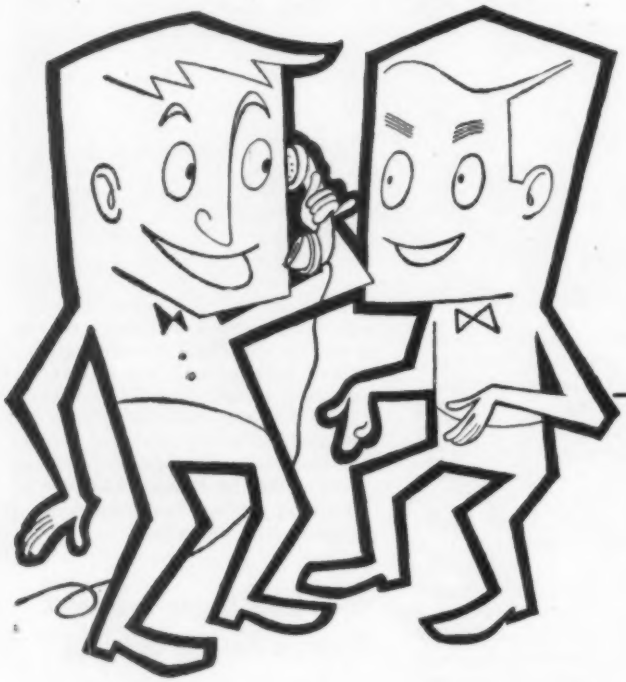
Water is your industry's most important raw material. Use it wisely.

Hall Laboratories, Inc.—Consultants on Procurement, Treatment, Use and Disposal of Industrial Water

For more data circle 530 on Post Card

How come you can get all the coal you want? Our deliveries have been slow!

That's because we buy all our coal from mines on the Chesapeake & Ohio. C & O has more coal cars than any other railroad and keeps close to 99% of them in good order. This ready car supply means an uninterrupted flow of coal to consumers.



How about the coal? Is that as good as the service?

C & O territory has always been known for the superior quality coal it produces. And the C & O fuel service engineer is always ready to help us find exactly the right coal for our particular needs.

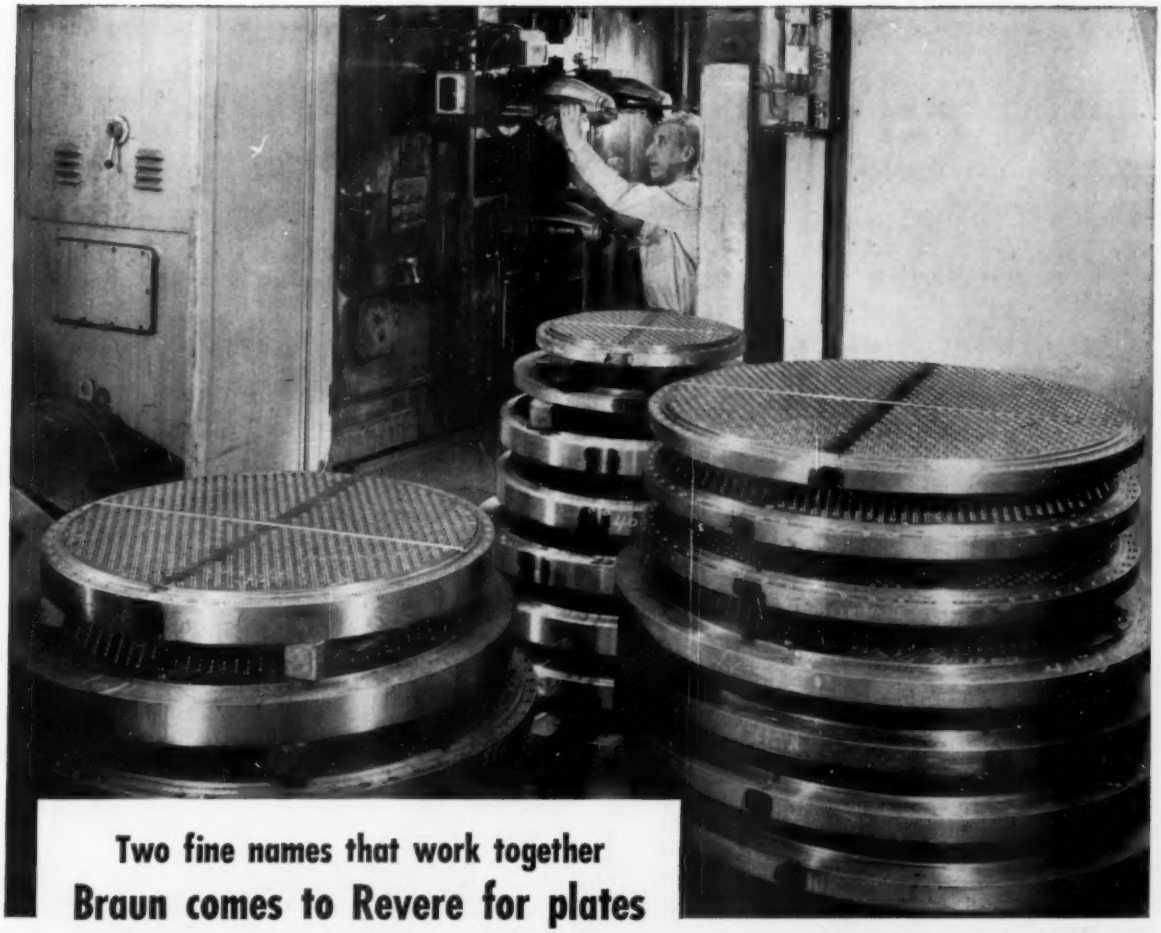
P.S.

There's a lot more to buying coal than the cost per million BTU. Why not contact coal producers on the C & O to solve your particular fuel requirements, or write to: R. C. Riedinger, General Coal Traffic Manager, Chesapeake & Ohio Railway Co., Terminal Tower, Cleveland 1, Ohio, for the assistance of a C & O fuel service engineer.

Chesapeake and Ohio Railway

WORLD'S LARGEST CARRIER OF BITUMINOUS COAL

For more data circle 531 on Post Card



Tube sheets at 4-spindle automatic drill in Braun shop.

Two fine names that work together

Braun comes to Revere for plates

C. F. Braun & Co., Alhambra, Calif. is well known in the petroleum industry, the chemical industry, and other businesses in which heat transfer and fractionation are vital. Revere Copper and Brass Incorporated is well known in the non-ferrous metal industry for its tube sheets and plates, in all the customary alloys. What is more natural than the close relations between the two companies, Revere the supplier, Braun the fabricator? Revere can furnish heavy plates when needed; Braun is one of the great heavy-duty shops of the country. So far as transportation limits permit, Braun fabricates in its own plant; their machines and their cranes can handle anything the railroads can haul away. The same is true of Revere, which is likewise known throughout heavy industry for its ability to produce not only large plates, but also condenser and heat exchanger tubes.

Revere is pleased to be an important supplier to Braun. Remember, good names find it good business to come together. The next time you want quotations on tube sheets and plates, and condenser tubes, get in touch with the nearest Revere Sales Office.

A Braun engineer inspects a drilled tube sheet.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

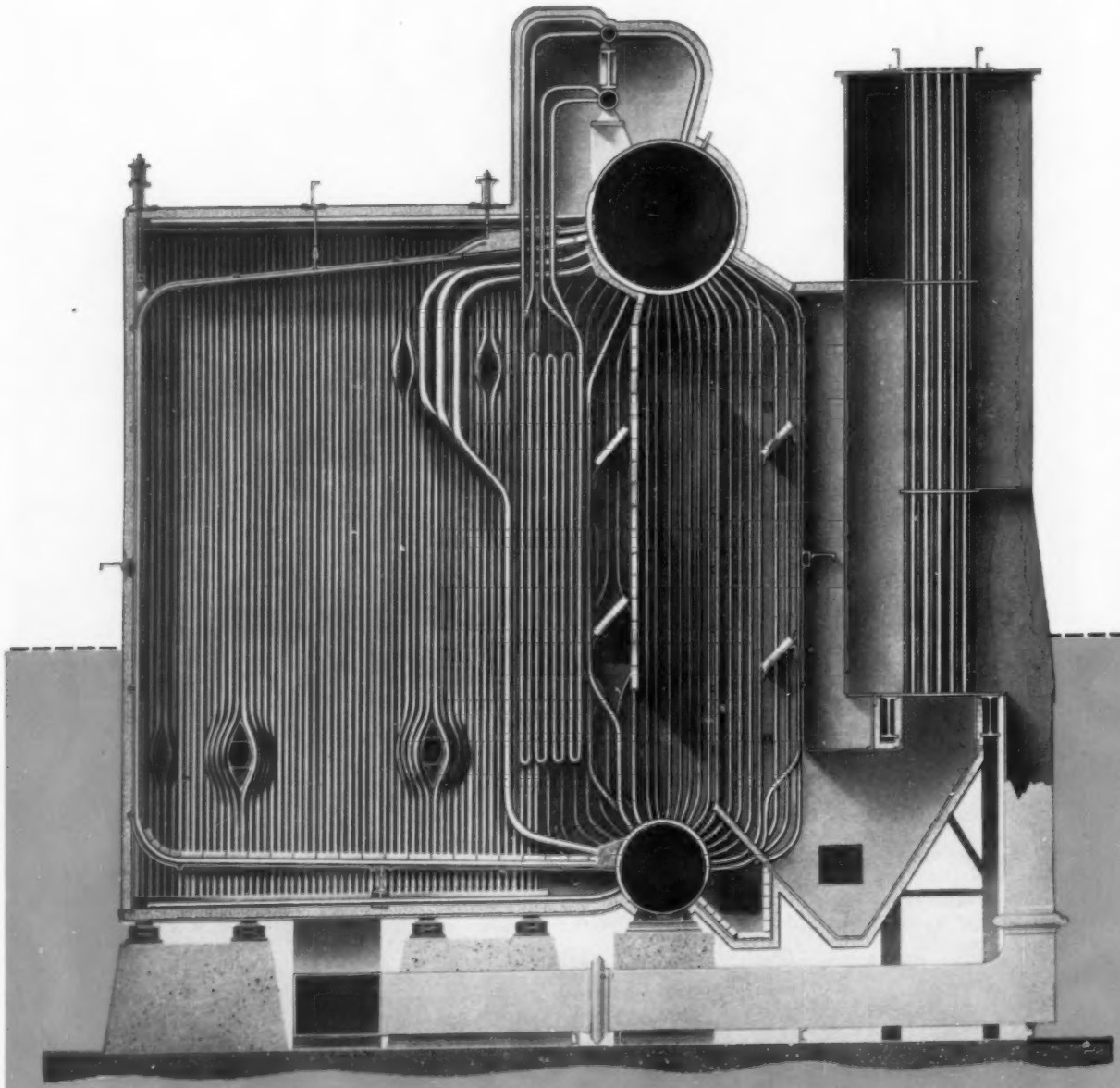
230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N.Y.
Sales Offices in Principal Cities, Distributors Everywhere.

For more data circle 532 on Post Card

These performance-proved features



SPECIFICATIONS

Sizes—Five sizes ranging from 50,000 to 120,000 lb of steam per hr.
Pressures—250 to 500 psi (all sizes)
Temperatures—as required up to 750 F
Fuels—oil or gas, pressure fired
Heat Recovery—Tubular or Regenerative Air Preheater

make Combustion's NEW VU-55

today's outstanding boiler buy for capacities from 50,000 to 120,000 lb of steam per hour!

The VU-55—a development of Combustion's basic *V*ertical *U*nit design—offers features never before available in a boiler of its capacity range. If your steam needs call for a unit in the 50,000 to 120,000-lb class, you will find it worth while to consider the economic and operating advantages assured by these VU-55 features:

TANGENTIAL FIRING. More than 20 years of application experience have established the exceptional advantages of tangential firing, illustrated and briefly described below. About 90 percent of Combustion's large utility installations use this advanced method of firing.

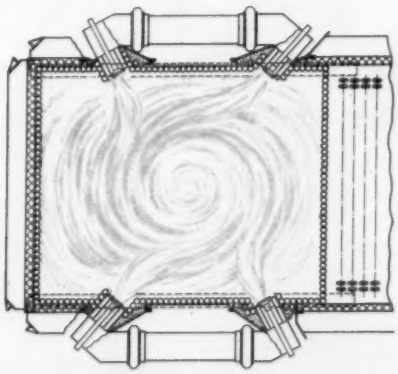
DOUBLE WALL, PRESSURIZED CASING. The latest development in casing construction for pressure firing of boilers in the size class of the VU-55, this casing, as illustrated and described below, is designed to assure life-time tightness with minimum heat loss. Pressure firing permits the elimination of an induced draft fan with its attendant operating and maintenance costs.

TANGENT FURNACE TUBES. The VU-55's furnace tube arrangement provides complete heat-absorbing, water-cooled protection on all furnace walls. Furnace maintenance is minimized since the design eliminates all exposed refractory surfaces.

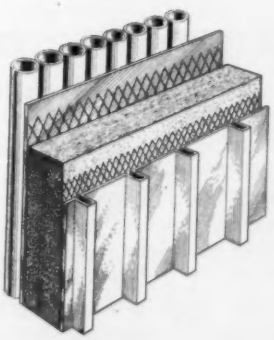
HIGH STEAM QUALITY. Equipped with a large (60-in.) steam drum, the VU-55 has generous water capacity and steam reservoir space. C-E drum internals assure high quality steam at all ratings.

STREAMLINED EXTERIOR. The over-all appearance of the VU-55 reflects the efforts of its designers to achieve a completely unobstructed casing, while retaining adequate access wherever required and every facility for convenient operation. There are no outside downcomer tubes, and ducts from air heater to burners are beneath the furnace floor.

Your request for further information on the VU-55 Boiler will receive prompt attention.



PLAN VIEW OF FURNACE showing arrangement of burners for tangential firing. Flame streams from the four burners impinge upon one another at high velocity, creating a turbulence unattainable by any other method of firing. The result is rapid and complete combustion. As the gases spiral upward, they sweep all furnace heating surfaces, assuring a high rate of heat absorption.



PERSPECTIVE OF FURNACE WALL. Construction consists of tangent tubes backed up successively by welded steel panels, 4 inches of high quality insulating material and an outer steel casing formed as shown to provide adequately for expansion and assure ample strength. Low heat loss and the tightness required for pressure firing are assured by this welded, double-wall construction.

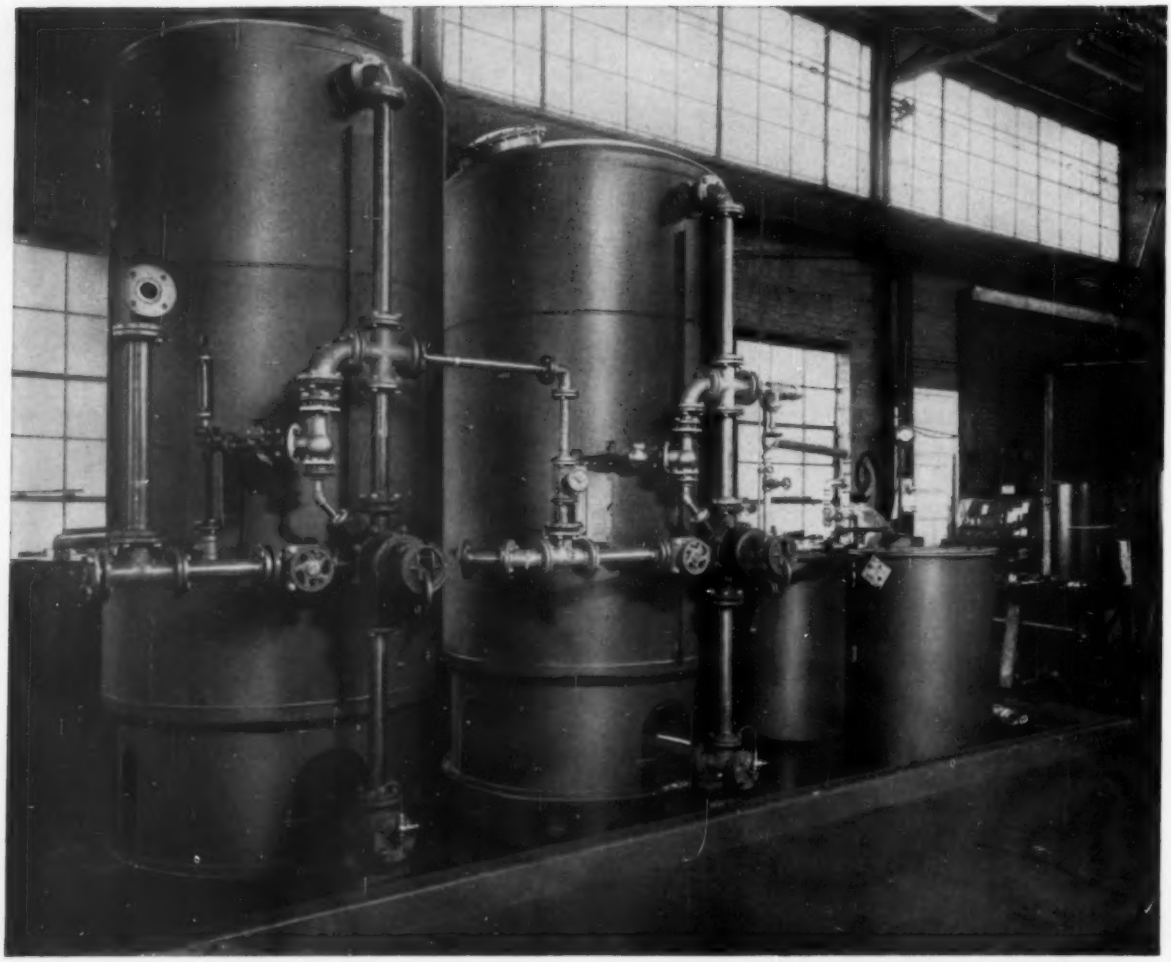
COMBUSTION ENGINEERING

Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.
CANADA: COMBUSTION ENGINEERING-SUPERHEATER LTD.

B-870

STEAM GENERATING UNITS; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; DOMESTIC WATER HEATERS; SOIL PIPE

For more data circle 533 on Post Card



Dearborn 2-Bed De-Ionizing Plant.

DEARBORN DE-IONIZING UNITS SUPPLY MINERAL-FREE WATER

This Dearborn De-Ionizing Plant produces 75,000 gallons of demineralized water daily. It reduces the mineral content in the water to the equivalent of that produced by distillation—at less cost. The unit is equipped with Saran-lined steel pipe, as well as rubber-lined tanks and valves.

Whether you require a manual, semi-automatic or fully automatic system, Dearborn gives you the properly designed unit to do the job.

When specifications call for mineral-free water, see Dearborn for a quotation.

The complete Dearborn line includes De-Ionizing Units, Zeolite Softeners, and Treatment Feeding Equipment to meet all requirements.

Dearborn®

SPECIALISTS IN WATER CONDITIONING AND CORROSION CONTROL SINCE 1887

USE THE COUPON FOR ADDITIONAL INFORMATION

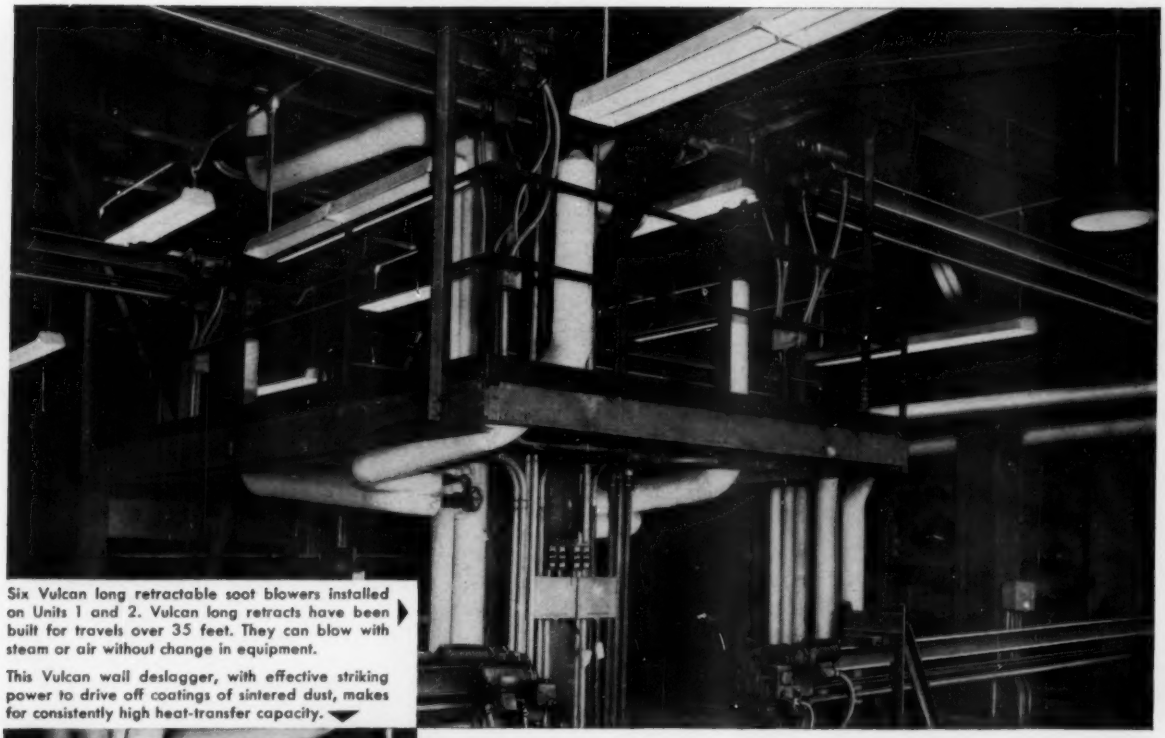
Dearborn Chemical Company, Dept. PG
Merchandise Mart Plaza, Chicago 54, Ill.

Please send me information on Dearborn's

- ☐ De-Ionizing Units
- ☐ Zeolite Softeners
- ☐ Treatment Feeding Equipment

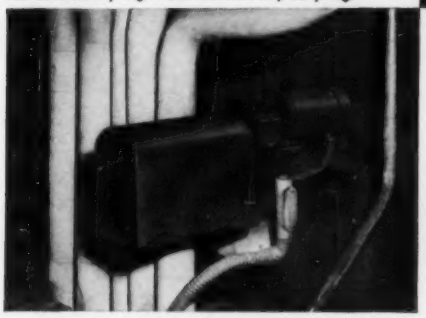
Name..... *Title*.....
Company.....
Address.....
City..... *Zone*..... *State*.....

For more data circle 534 on Post Card

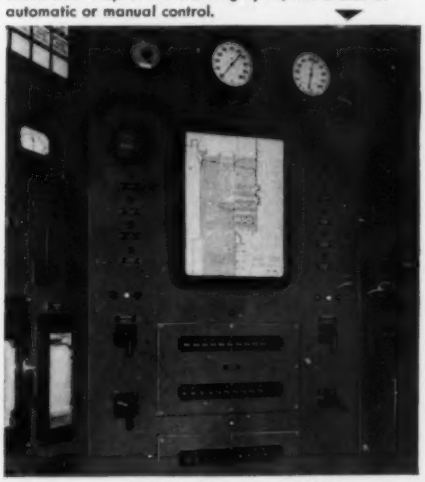


Six Vulcan long retractable soot blowers installed on Units 1 and 2. Vulcan long retracts have been built for travels over 35 feet. They can blow with steam or air without change in equipment.

This Vulcan wall deslagger, with effective striking power to drive off coatings of sintered dust, makes for consistently high heat-transfer capacity.



From this central control panel, the operator can check each step of the cleaning cycle; has choice of automatic or manual control.



Georgia Power Company installs VULCAN automatic-sequential soot blowing system

Keeping three Babcock & Wilcox reheat boilers effectively clean is a push-button operation at Georgia Power Company's Plant Hammond. That's because each boiler is equipped with Vulcan Automatic-Sequential Soot Blowing. The system includes both long retractable soot blowers and wall deslaggers.

The centralized control panel for each electrically-driven system is located in the main boiler control room. There the operator starts the cleaning sequence by simply pushing a button. He can see at a glance that each unit starts operation at the right time and pressure, blows for the proper period, and cuts out of service. If an individual blower requires more frequent or prolonged operation, manual control is right at his fingertips. With Vulcan, each boiler section is cleaned efficiently, automatically. No soot or slag accumulates to decrease operating efficiency.

No matter what size your boiler—whether it's power or process—you can increase operating efficiency and get low cost, effective cleaning with Vulcan Automatic-Sequential or Selective-Sequential Soot Blowing.

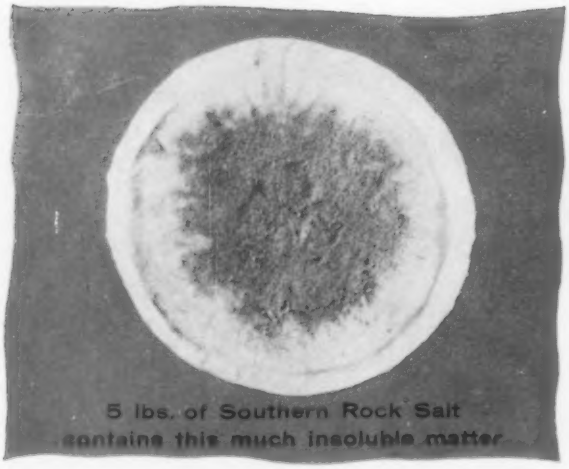
COPES-VULCAN DIVISION

BLAW-KNOX COMPANY

ERIE 4, PENNSYLVANIA

50th Anniversary BLAW-KNOX 1906-1956

For more data circle 535 on Post Card



5 lbs. of Southern Rock Salt contains this much insoluble matter

5 lbs. of Northern Rock Salt contains this much insoluble matter

All filter pads shown, approximately ⅓ actual size. Tests for insolubles were taken from random samples.

5 lbs. of Kansas Rock Salt contains this much insoluble matter

5 lbs. of Morton Purex Evaporated Salt contains no insolubles

Morton Purex Salt is the only one that contains no costly insolubles

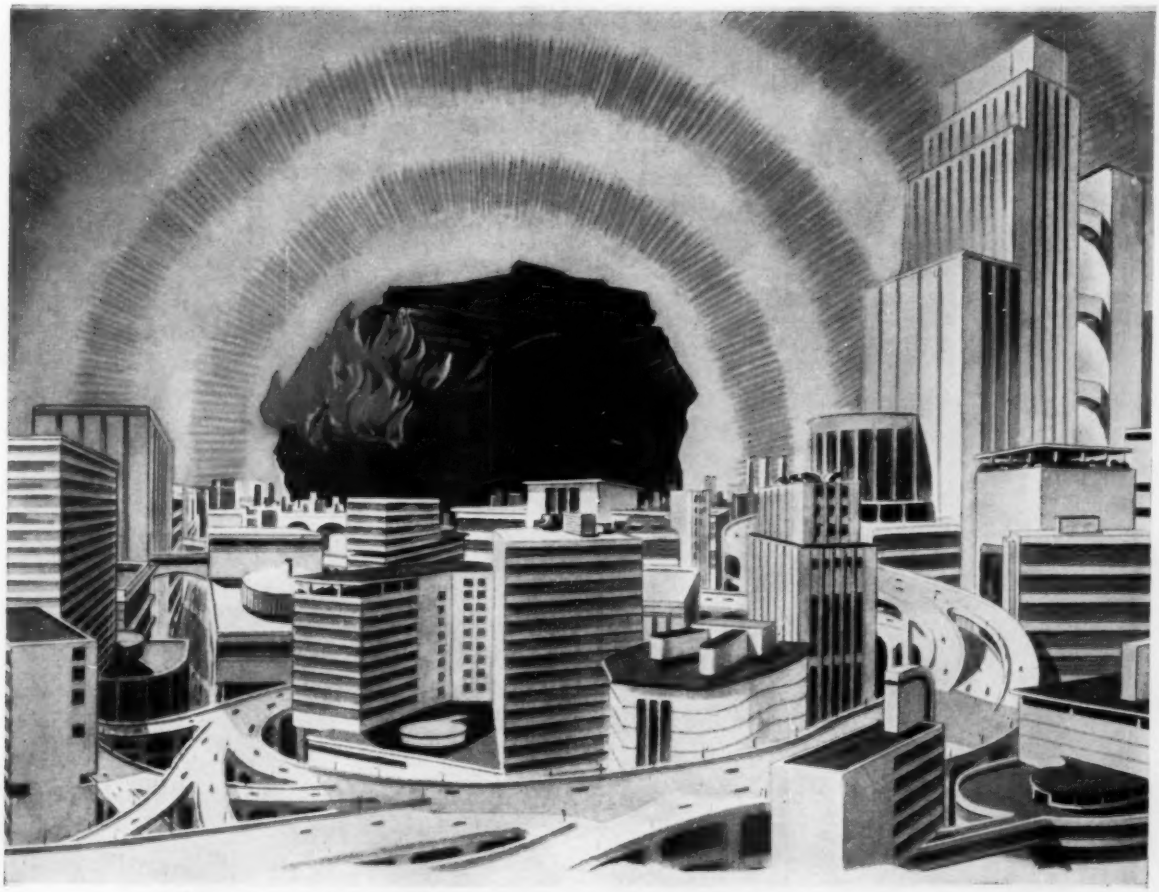
When you buy Morton Purex Salt, you get high purity evaporated salt that is made in a controlled-particle size to prevent packing and channeling. None of your freight bill or purchase price goes toward paying for shale and sulphates . . . insolubles like those shown on three of the filter pads above. (And the cost can be considerable. In every 100 lbs. of any of the types of rock salt shown above, you are paying for up to 5 lbs. of insolubles.)

With Purex, no time or labor is spent cleaning out insoluble matter from your brine making system to keep it functioning at peak capacity. For Purex is 100% soluble. Morton Purex will leave no accumulation of material in either the brine or water softener tanks. It can be used in bulk wet storage systems and in the Morton Model E Brinemaker.

For more information about Morton Purex Salt or for free, expert help on any water softening or brine making problem, write or wire:

MORTON SALT COMPANY
INDUSTRIAL DIVISION
Dept. PoE-3, 120 So. La Salle Street, Chicago 3, Illinois

For more data circle 536 on Post Card



The fuel that sparked our nation's growth secures her greater future

A young America—primed by a new and power-packed fuel—became a great industrial giant almost overnight. Coal had supplied the first unwavering spark which was to grow into the brightest productive flame the world has ever known.

After being served so well in the past and present, America looks again to dynamic coal for greater prosperity and security in the future. The vast Bituminous fields along the Baltimore & Ohio contain excellent coals in wide variety—available for centuries to come.

BITUMINOUS COALS FOR EVERY PURPOSE

Highly mechanized mines, equipped and ready for any demands, will help maintain long-range cost stability. And improved utilization methods will meet the increased requirements of the future by providing greater coal-burning efficiency.

CALL ON OUR COAL TECHNICAL SERVICE

You'll receive complete information from trained B&O experts about the kind and size of Bituminous coal that fits your needs best—at a price you want to pay. Write:

COAL TRAFFIC DEPARTMENT
BALTIMORE & OHIO RAILROAD
BALTIMORE 1, MARYLAND

LINKING 13 GREAT STATES WITH THE NATION — B&O

Baltimore & Ohio Railroad

Constantly *doing things* — better!

For more data circle 537 on Post Card

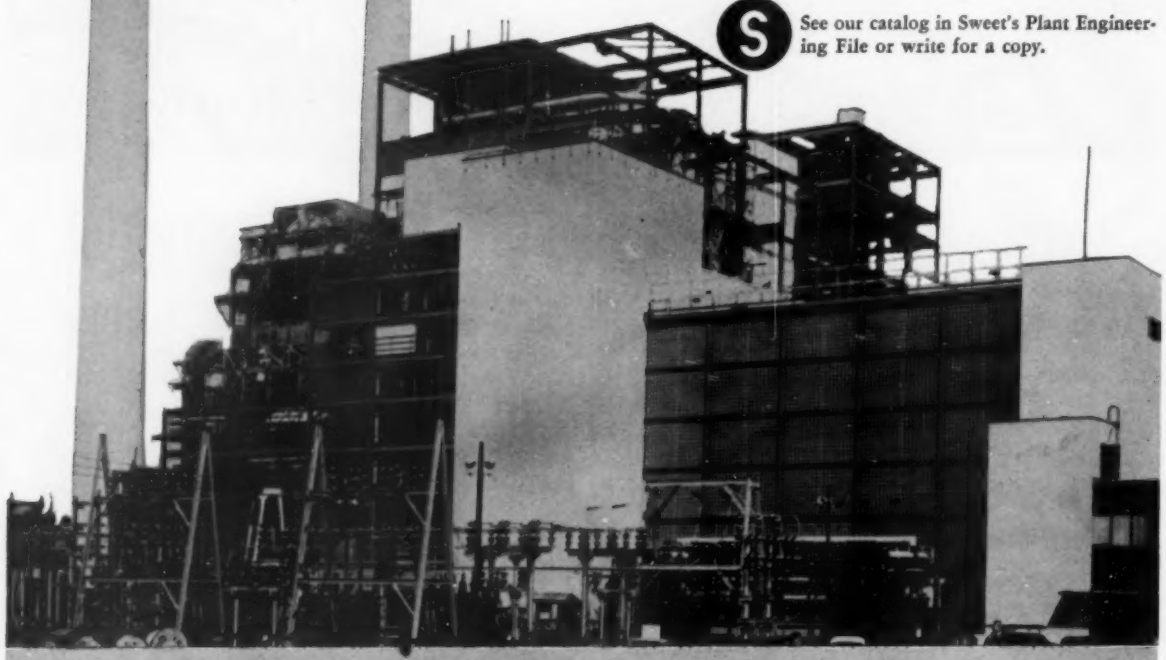
BALDWIN-HILL
Spun Mineral Wool
MONO-BLOCK

met rigid thermal requirements . . . simplified installation methods at Philadelphia Electric's Cromby Station

- B-H one-block insulation, MONO-BLOCK, simplified inventory of materials. Met requirements for both low and high temperature insulation.
- Light weight, ease of handling, cutting and shaping helped speed application.
- Felted structure of MONO-BLOCK yields to surface projections and irregularities without breakage; easily impaled on studs.
- Provides exceptional stability under severe temperature and moisture conditions.

BALDWIN-HILL COMPANY
204 Breunig Avenue . . . . . Trenton 2, N. J.
Huntington, Ind. . . Kalamazoo, Mich. . . Temple, Texas

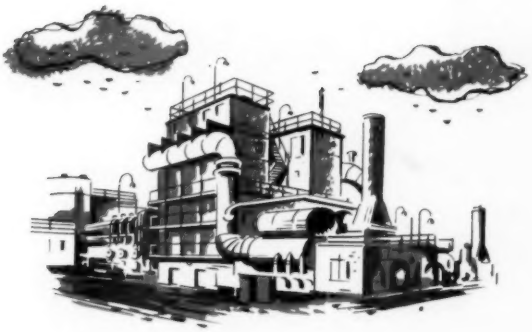
S See our catalog in Sweet's Plant Engineering File or write for a copy.



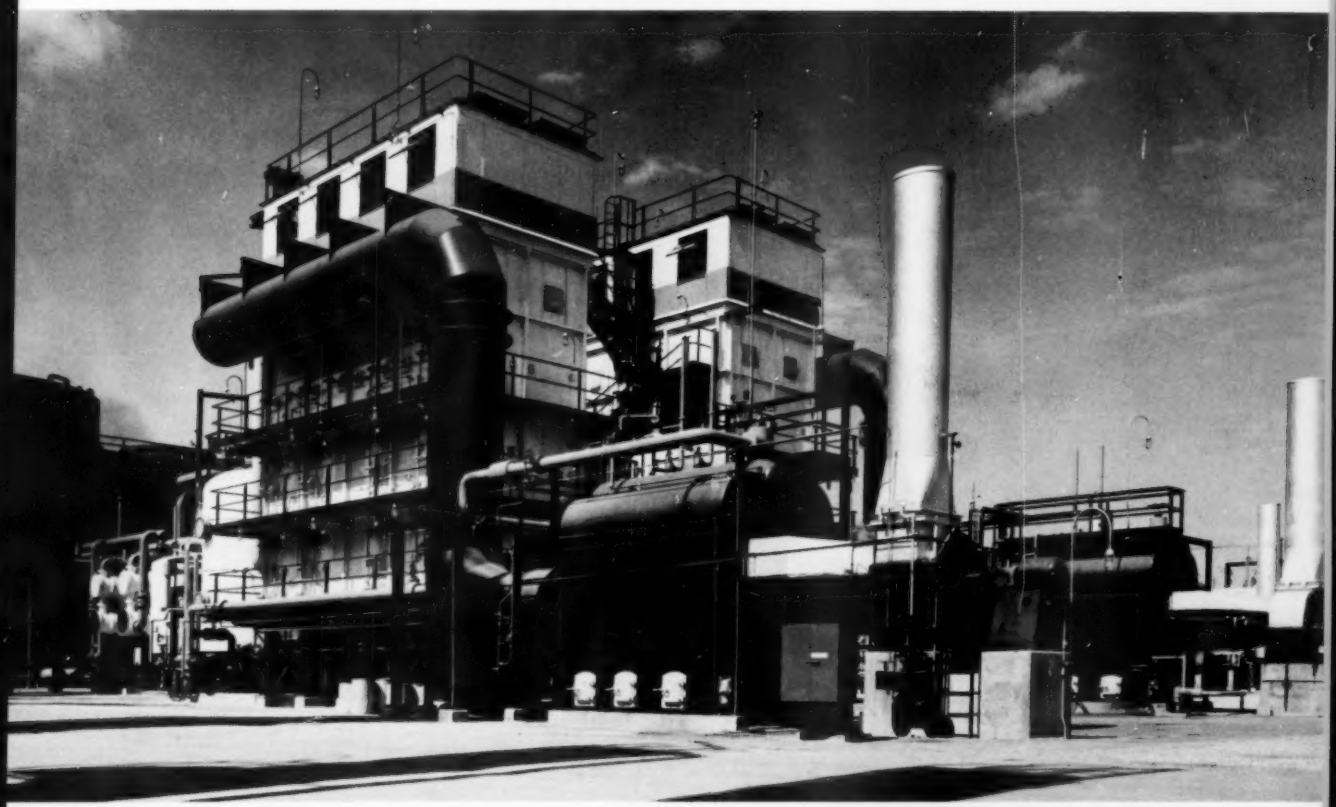
COMPLETE LINE OF BALDWIN-HILL INSULATING PRODUCTS

B-H Mono-Block	B-H Super Powerhouse Cement	B-H No. 100 Pipe Insulation
B-H Blanket	B-H No. 1 Insulating Cement	B-H 85% Magnesia Pipe Insulation
B-H Koldboard	B-H No. 52 Asbestos Cement	B-H Calcium Silicate Pipe Insulation
B-H Bond-Tite	B-H Spun Felt Insulation	B-H Mono-Kover Pipe Insulation
B-H Weatherseal	B-H Fine-Fyber Felt Insulation	B-H Spun Mineral Wool Fill

For more data circle 538 on Post Card



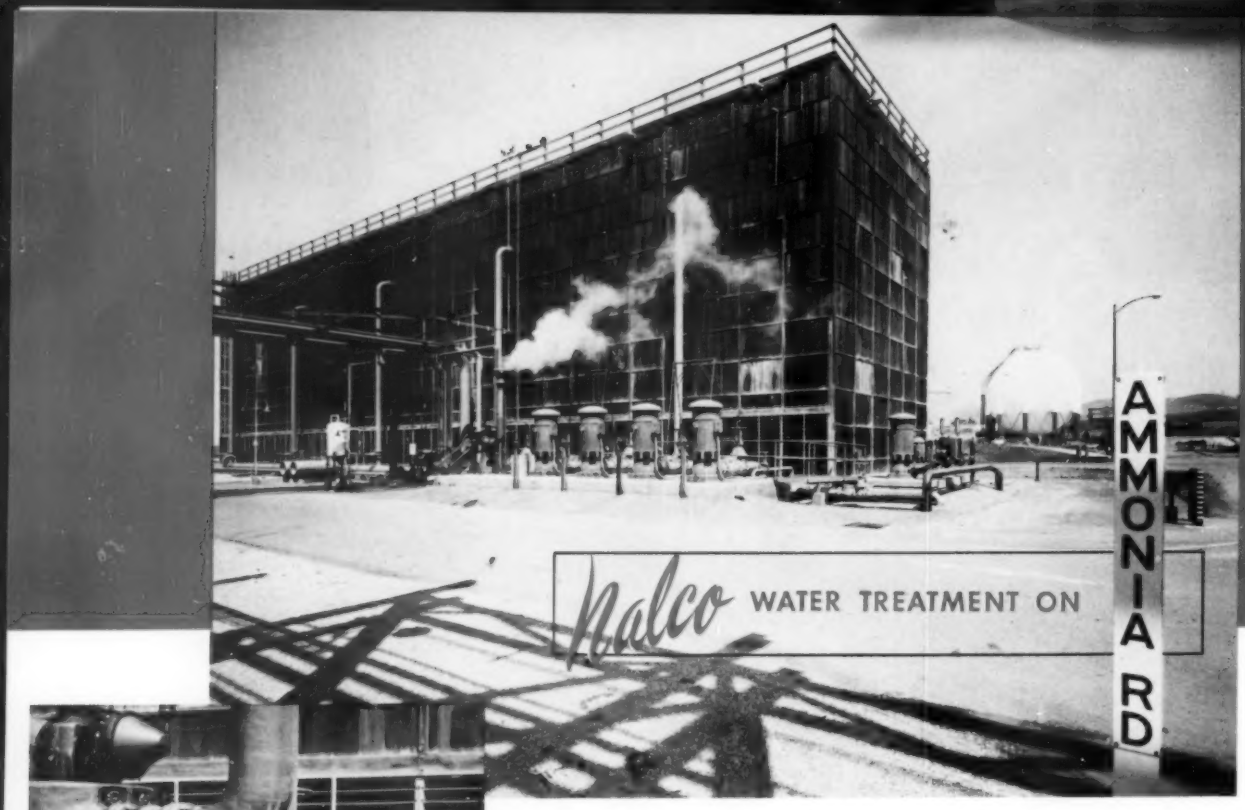
Water treatment by NALCO protects boilers and cooling system of big new ammonia plant

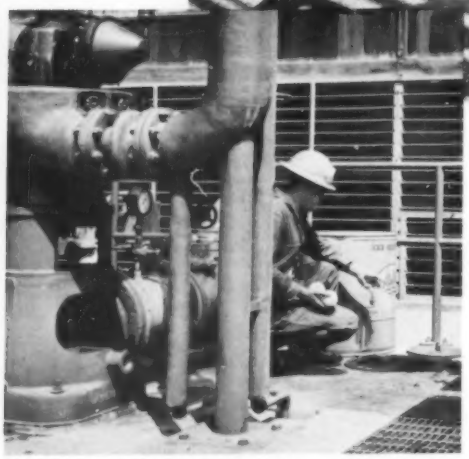


Processing units (left) and Nalco-protected waste heat boilers in new $13 million Brea Chemicals, Inc. ammonia plant.

When $13,000,000 goes into a brand new ammonia plant . . . equipment, services and supplies must be right up to snuff from the start. The Nalco System has been working here from the beginning—and the Nalco treatments and services rendered in a successful plant-wide program point up the advantages to be gained with the Nalco System in plants new or old.

See the next page for details on Nalco results on Ammonia Road.



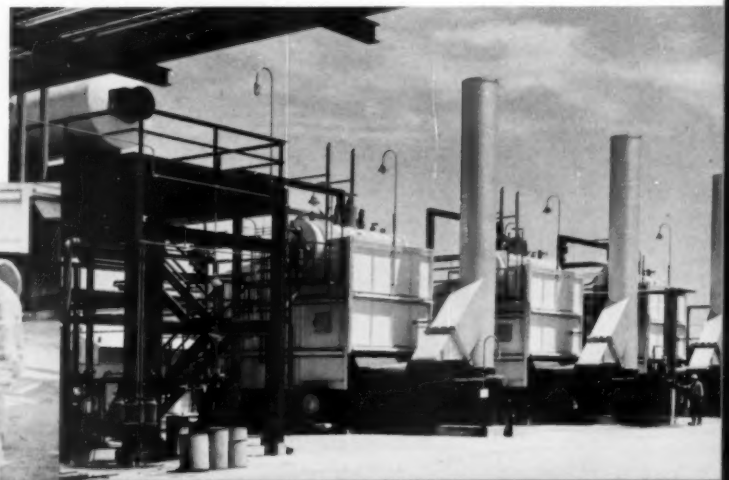


Top—Large cooling tower at this new west coast ammonia plant gets protection against scaling and corrosion with a non-toxic Nalco formula. Low pH treatment stops deterioration of cooling tower lumber and cuts dosage requirements for slime and algae control.

Above—Ball form cooling water treatment is merely dropped into a simple wire basket device suspended in cooling tower basin.

Nalco System treatments on Ammonia Road solve these important water and steam processing problems: scale and corrosion prevention in both water and steam systems; boiler-water foam control and sludge-conditioning; and contamination-free process steam.

Whatever your water treatment problems may be—in a plant of any size—there is a Nalco System program designed to solve them, permanently . . . and economically. Write or phone today for details.



Above—Three steam generators on outdoor settings provide super-pure steam for ammonia processing and heating. Nalco chemicals in ball-briquet form are put into by-pass feeders *(left)* to insure trouble-free water treatment on Ammonia Road.

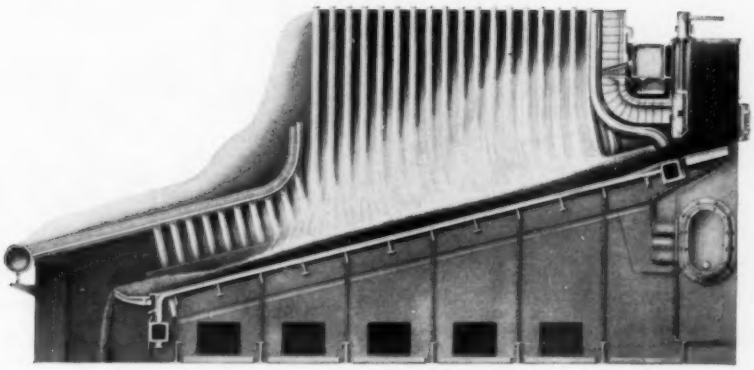
NATIONAL ALUMINATE CORPORATION
Phone: POrtsmouth 7-7240
6216 West 66th Place
Chicago 38, Illinois

In Canada, Alchem Limited
Burlington, Ontario

THE *Nalco*® SYSTEM . . . Serving Industry through Practical Applied Science

CHEAP COAL-- *something to get steamed up about with an*

AE VIBRA-GRATE



WHAT COAL best fits your plant pocketbook? High or low fusion? West Virginia, Illinois, or Western Kentucky? American Engineering's unique Vibra-Grate Stoker burns them all efficiently... with complete freedom from clinkers ...with low excess air and low carbon loss.

Completely water-cooled, the Vibra-Grate burns low grade fuels without smoke at either low or high ratings... and no dust collectors are necessary. Stack emission will comply with all local ordinances.

Herewith is the analysis of three coals recently burned successfully on a Vibra-Grate of 45,000 lbs. steam per hour capacity. These results are typical of others obtained with a wide variety of coals on a Vibra-Grate at the Columbus, Ohio Laboratory of Bituminous Coal Research, Inc.

PROPERTIES	ILLINOIS	WESTERN KY.	WEST VA.
Moisture	9.0	5.7	1.55
Ash	7.73	8.1	5.65
Volatile	35.85	38.6	31.44
Fixed Carbon	47.42	47.6	61.36
Sulphur	1.18	3.3	0.657
B.T.U.	12,121	12,500	13,560
Ash Softening Temp.	2120°	2050°	2700°

IN SERVICE NEARLY A DECADE

Vibra-Grate Stokers of present design have been in service abroad since 1947, and earlier versions, since 1939. If you plan to install a new boiler or restoker an old one with capacities from 20,000 to 150,000 lbs. steam per hour, write for full facts about Vibra-Grate's amazing combination of advantages.

STOKER INCINERATOR GRATES, TOO

A properly engineered stoker incinerator is today's best answer for refuse disposal... and AE's know-how in stoker design is your best assurance of all-around incinerator efficiency. Your inquiries are invited.

AMERICAN ENGINEERING COMPANY

DEPT. S-101, WHEATSHEAF LANE & SEPVIVA STREET, PHILADELPHIA 37, PA.

Canadian Subsidiaries: Affiliated Engineering Corporations, Ltd., Montreal, P. Q.... Bawden Industries Ltd., Toronto, Ont.

AE products are: Taylor, Perfect Spread and Vibra-Grate Stokers, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers, Marine Deck Auxiliaries.

For more data circle 540 on Post Card

CONSTRUCTION NEWS

El Segundo, Calif. — The Los Angeles Department of Water & Power plans construction of new steam-electric generating plant on local site. Construction work will begin early this year on two generating units, each with a rated capacity of 156,000 kw. Initial installation is scheduled for operation by September 1958 and the second scheduled to be in operation by October 1959. Plant when completed will cost an estimated $59,700,000.

Los Angeles, Calif. — Southern California Edison Co. may acquire 80 acres of property in Orange County for a new generating station. Company proposes to install two 200,000-kw generating units initially and ultimately to make the station one of the largest in the company's system. Cost of power plant and initial installation of power generating units will represent an investment of better than $60,000,000.

Atlanta, Ga. — The Georgia Power Company, Electric and Gas Building, has arranged a construction budget of about $41,000,000 for 1956. Biggest item in the construction program for this year will be a $17,500,000 expenditure for distribution lines to supply an additional 23,000 customers. Another $8,000,000 will be expended on 500 miles of new transmission lines. The 1956 budget includes an amount of $13,600,000 for work on two steam-electric generating units at company's Plant Yates on the Chattahoochee River. The two 125,000-kw generating units will bring station generating capacity to 550,000 kw when completed.

Chicago, Ill. — The Commonwealth Edison Company has authorized plans for a 305,000-kw steam-electric turbine generator, to be built by Allis-Chalmers Manufacturing Co. It is the second of this size ordered by the utility in the last few weeks. New unit will be installed at the Fisk Station and is in line with increased budget for construction expenditures of $120,000,000, over the next four years for the company. The entire $600,000,000 program provides an estimated $275,000,000 for new generating facilities, $310,000,000 for transmission, substation and distribution facilities and $15,000,000 for plant expansion.

Holyoke, Mass. — The City of Holyoke has submitted a proposal to the Atomic Energy Commission for a $10,000,000, 15,000-kw atomic power plant of a new design, to supplement the city's conventional power supply system. Plans for the plant have been drawn up by the Gas and Electric department of the City of Holyoke, which supplies domestic and commercial electric power in the city and two New York concerns, — the Ford Instrument Company of Long Island and Sanderson & Porter, a consulting engineering firm.

Salem, Mass. — New England Electric System, Boston, Mass., announced it has plans under way for the construction of new generating plant at Salem Harbor. The Stone & Webster Engineering Corp. has been awarded construction contract reported to be $20,000,000.

Jackson, Michigan — Consumers Power Company has plans under way for the construction of new power plant on Michigan's Saginaw Bay. Construction of initial generating unit will get under way this summer for operation in 1959. Additional units planned for this site will ultimately bring plant's total capacity to better than 1,500,000 kw, or greater than present capacity of company's entire system. Cost of new generating unit to be installed has not yet been determined.

Chillicothe, Mo. — The City of Chillicothe has plans under way for expansion and additions to municipal power plant. Work will include plant addition, building work and electrical work. Cost of improvements reported to be $1,385,000. Stanley Engineering Company, Hershey Building, Muscatine, Iowa, engineer.

Buffalo, N. Y. — Niagara Mohawk Power Corp. plans addition to local steam electric generating station, with installation of a new 200,000-kw steam electric generating unit at its Charles R. Huntley station. The new generator scheduled for service in late 1958 is reported to cost in the neighborhood of $30,000,000. A similar unit, now under construction, is expected to begin operation sometime next year. These two generating units, costing a total of $60,000,000, will increase total capacity of Huntley Station to 1,200,000 kw.

Mineola, N. Y. — The Long Island Lighting Co. has plans for construction of a new giant power plant at Northport, L. I., 41 miles east of New York City. The new station will be built on a 250 acre site the utility is now in the process of purchasing from the Metropolitan Sand & Gravel Corp. While the size of the station's steam electric generating units has not as yet been determined, it is expected that the first of these units will cost about $30,000,000 for scheduled operation in 1964. The second unit to cost a like amount is scheduled for operation in 1970. Station may eventually have a generating capacity of 1,000,000 kw.

New York, N. Y. — Consolidated Edison Co. expects to spend $120,000,000 on expanding electricity, gas and steam distribution and producing facilities during 1956. Company has budgeted $78,000,000 for new electricity distribution lines and plants; $30,470,000 for new electric generating capacity, with the remainder of $11,530,000 earmarked for expanding gas distribution network. Company proposes to start work on three giant electric generating units to add more than 900,000 kw to present 3,696,000 kw capacity over next five years. A 250,000-kw atomic power generator is planned at Buchanan, N. Y.

Memphis, Tenn. — The City of Memphis has recently employed the firm of Salomon Bros. & Hutzler, New York, N. Y., as advisors on the city's proposed bond issue totaling about $135,000,000 to finance its municipal power plant now under construction. Syndicate will be formed to sell bonds, proceeds of which will be used to finance construction of power plant to supply Memphis' electrical needs after June 1, 1958, when city's contract for power from Tennessee Valley Authority expires. City has already awarded contract for three steam turbine generators, each rated at 250,000 kw, to Westinghouse Electric Corp. Burns & Roe, consulting engineers, are planning the power plant.

Beaumont, Texas — Gulf States Utilities Co., subsidiary of Engineers Public Service Co., New York, N. Y., has announced plans for a major expansion in generating facilities at Neches Power Station, Beaumont, Tex. New steam electric generator of 111,000 kw capacity will be installed to boost utility's total electricity producing capacity to 947,000 kw when put into commercial operation early in April of 1958. Stone & Webster Engineering Corp. has been awarded contract for design and construction work, to begin soon. Cost of project not announced, but will represent an investment approximating $15,000,000.

Corpus Christi, Texas — The Central Power & Light Company has made arrangements for financing through the sale of first mortgage bonds in the amount of $10,000,000, proceeds to be used for extensions and improvements in generating facilities, power substations, transmission lines and other facilities.

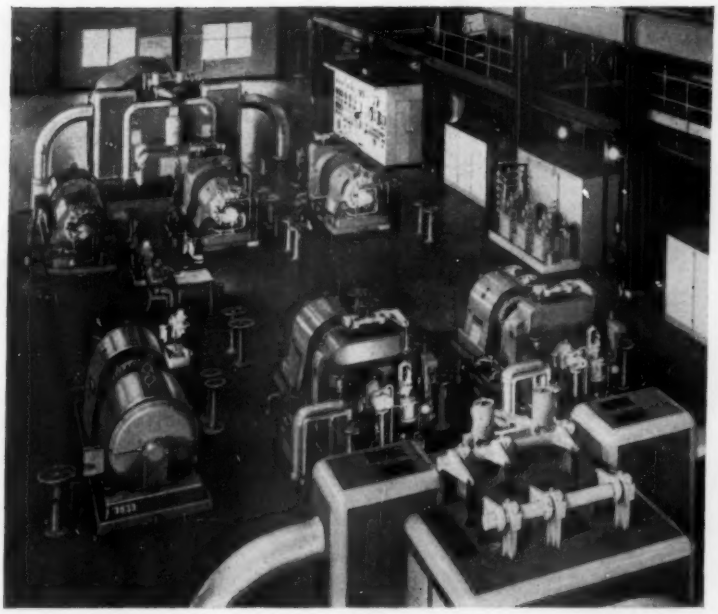
Dallas, Texas — Dallas Power & Light Co. has arranged a construction program for 1956 and 1957, estimated to cost about $20,700,000 and $23,100,000, respectively. Work will include additional generating facilities, transmission lines, power substations and other operating facilities.

Lubbock, Texas — Municipal Power and Light, City of Lubbock, has entered into an Engineer-Constructor contract with Nelson Miner and Co., engineers, of Comfort, Texas, and H. B. Zachry Co., constructors, of San Antonio, Texas, for the design and construction of a 22,000-kw steam turbine generator plant at Lubbock, Texas. In this joint venture the Zachry Co. is responsible for construction management and the Nelson Miner Co. for design engineering. Cost of the project is estimated to be $2,530,000. Engineering and construction to be completed in 15 months.

Carbo, Va. — Appalachian Electric Power, operating subsidiary of American Gas & Electric, Roanoke, Va., has plans for the construction of a new 450,000-kw steam electric generating plant on a 105 acre tract of land, to be purchased outright from the Clinchfield Coal Corp. Plant will be adjacent to Clinchfield coal mines which will supply fuel for the two 225,000-kw generating units, which are expected to consume 1,300,000 tons of coal annually. Excavation work is scheduled for April 1956 with number one unit scheduled to be in operation by early 1958 and number two unit later that year. Project when completed to cost $55,000,000.

Captina, W. Va. — Ohio Power Co. has authorized plans for construction of a new steam-electric generating plant at Captina, W. Va., in conjunction with Olin Mathieson Chemical Corporation's aluminum project at Clarington, Ohio. Plant will be designed for development up to 1,350,000 kw capacity with initial installation of two steam-electric generating units of 225,000-kw each. Pittsburgh Consolidation Coal Co. and Olin Mathieson Chemical Corp., operating as a joint subsidiary, Cresap Generating Co., will own one of the two 225,000-kw power units at the new plant and Ohio Power Co., the second unit.

What makes a barrel-type boiler feed pump *stay in service?*



Here are some of the design features that assure dependability

Today's modern multi-stage centrifugal pumps for boiler feed service are the result of years of research and design. To provide efficient service *plus* dependability, De Laval has incorporated these important features in its barrel-type pump.

Double Volute Diaphragms

Double volute diaphragms provide for radial hydraulic balance and assure a continuous rising head characteristic from the design point to shut-off. *RESULT—Higher efficiencies are maintained over a wider range of operation than are generally obtained with other forms of velocity pressure conversion.*

Individual Diaphragm Bolting

Elimination of rabbet fits and gaskets permits straight metal-to-metal contact of adjacent lapped faces of the diaphragms which are individually bolted together to maintain tight joints and ease of assembly. *RESULT—Positive assurance against inner case leakage, complete elimination of misalignment causes and a minimum of distortion from sudden temperature changes.*

Positive Sealing Between Suction and Discharge Chamber

Inner assembly is held at the inner high pressure joint at the suction end of the barrel, against a flexitallic gasket, with through bolts. The joint between the suction and discharge chambers is made tight during assembly—remains tight whether pump is operating or idle. *RESULT—No possibility of leakage or gasket loosening due to changes of force on the inner joint.*

Bare Shaft

Bare shaft construction with split ring-shrink fit method of impeller mounting permits a scalloped shaft design and eliminates the need for spacer sleeves between impellers. *RESULT—Better hydraulic conditions at the eye of the impeller and elimination of spacer sleeves—the greatest cause of shaft warpage.*

Wearing Rings

Diaphragms and impellers have renewable wearing rings. Impeller rings are threaded on the impeller hubs against rotation, and diaphragm rings are held by a breech lock fit in the diaphragms. *RESULT—Construction permits renewal of original clearances without major part renewal or modification. Labyrinth type diaphragm ring results in minimum leakage over a longer period of time than with close clearance flat rings.*

IMO Oil Pump

A De Laval IMO pump designed for high speed operation is direct-connected to the outboard end of the barrel pump shaft, and is sized to lubricate both pump and driver bearings. *RESULT—Quiet, pulsation-free, positive displacement IMO pumps, assures positive lubrication and eliminates the need of extra shaft length and mechanical complications required by gear drive lube oil pumps.*

BULLETIN CONTAINS HELPFUL DATA

This De Laval bulletin on the barrel-type boiler feed pump covers all major design points . . . has cross-section cut-away illustration for easy reference. Write on your business letterhead for your copy of Bulletin 1506 to De Laval Steam Turbine Company, 816 Nottingham Way, Trenton 2, New Jersey.

EQUIPMENT NEWS

Described on these pages are new and improved products. Use Reader Service Cards on pages 133–134 to ask for more information on them. Just circle the item numbers of all the products in which you are interested.

1—GAS ANALYZER for stack, exhaust gases

The Model 150 RF Gas Analyzer, designed for the analysis of stack and exhaust gases in smog control, is described as a rugged mass spectrometer that operates on a radio frequency principle. Instrument sorts and identifies masses by their molecular weights and will monitor concentrations of gases in process streams. Preset as desired to monitor six different masses, setting can be changed to monitor other masses also. Tuning to any of the masses or "mass peaks" is accomplished by flipping a switch. An accessory provides for cyclic monitoring of selected gases at a rate of one every ten seconds. Housed in a compact metal shell, the unit is reported to offer sensitivity, stability and simplicity of operation, and low price. Beckman Instruments, Inc.

2—GAGE CASE designed for increased safety

Announced as providing maximum safety on dangerous installations, the Safecase has a solid front to protect the gage face, and a thin stainless plate, covering the entire back of the case, to

relieve explosive pressures. The back plate is held to the base by two holding screws to eliminate possibility of the back plate becoming detached in the event of a blow-out. Manufacturer reports that in experimental tests, blank cartridges were fired into the gage, and the glass face didn't even crack; the thin metal back plate folded outward and the force was safely exhausted out of the back. Jas. P. Marsh Corp.

3—AIR ELIMINATOR for high pressure equipment

The No. 12 High Pressure Air Eliminator is announced for automatically venting equipment using steam pressures from 0 to 150 lb. It is designed for fast venting and automatic closing on steam processing equipment, such as driers, steam coils, steam mains, unit heaters, laundry equipment. According to manufacturer, the eliminator offers design improvements that provide greater dependability and longer valve life under the extreme conditions of high pressure steam venting. Gorton Heating Corp.

4—LIQUID COOLERS are completely assembled units

These packaged liquid coolers are designed to meet the heavy duty requirements of industry to produce chilled liquids in volume, quickly and at low cost. Package includes a complete refrigeration cycle, compressor, motor and starter, refrigerant controls, liquid cooler, condenser, piping, wiring and insulation, shop assembled and tested, ready for quick installation and immediate operation. The units are available in a range of sizes from 5 to 100 hp and for temperatures from 65 to 100 F. The Doyle & Roth Mfg. Co., Inc.

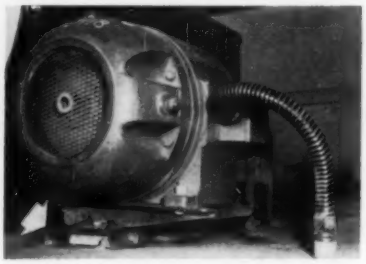
5—EPOXY COMPOUND simplifies electrical cable splicing

Thoxene Clamp-Coat is a hard-setting plastic compound developed for rapid field insulation and weatherproofing of cable splices. The material is also used as a sealant for gas lines. Packaged in a compartmentalized polyethylene container, the compound is ready to use as soon as its two components are mixed. By covering the splice with the activated formulation and letting it harden (setting time is 2½ to 3 hr) a weatherproof, abrasion-resistant coating with high electrical insulation is achieved, says manufacturer.

The mixture contains no solvent, and coatings up to ⅛-in. thick can be applied without dripping off. This compound's high resistance to moisture, abrasion and impact, and adhesion to wires, are attributed to use of company's Epon resins in the formulation. These epoxy resins are also said to help attain unusual electrical and mechanical properties. To use the material, you remove the metal clips separating the base formulation and activator in the plastic package; then stir with the applicator provided. One component is blue, the other, yellow, so that a complete mixture is indicated by a uniform green color. Shell Chemical Corp.

6—MOTOR BASE automatically adjusts belt tension

The No. 500 Tens-A-Matic Motor Base is said to require no regular maintenance for proper drive belt tension; automatically takes up belt stretch and automatically absorbs starting loads. Shown in-



stalled on this base is a totally-enclosed, fan-cooled ball-bearing 40-hp 1800-rpm motor, which weighs 590 lb and drives an exhaust fan without maintenance down time. According to company, the Tens-A-Matic cuts belt-changing time into a matter of minutes. If belts need replacing, motor is just tilted forward and blocked for this operation. Base eliminates motor or belt realigning, says manufacturer, as it again automatically adjusts new belts to proper tension. It is available for motors of all sizes, from fractional horsepower to 200 hp. Murray Equipment Co., Inc.

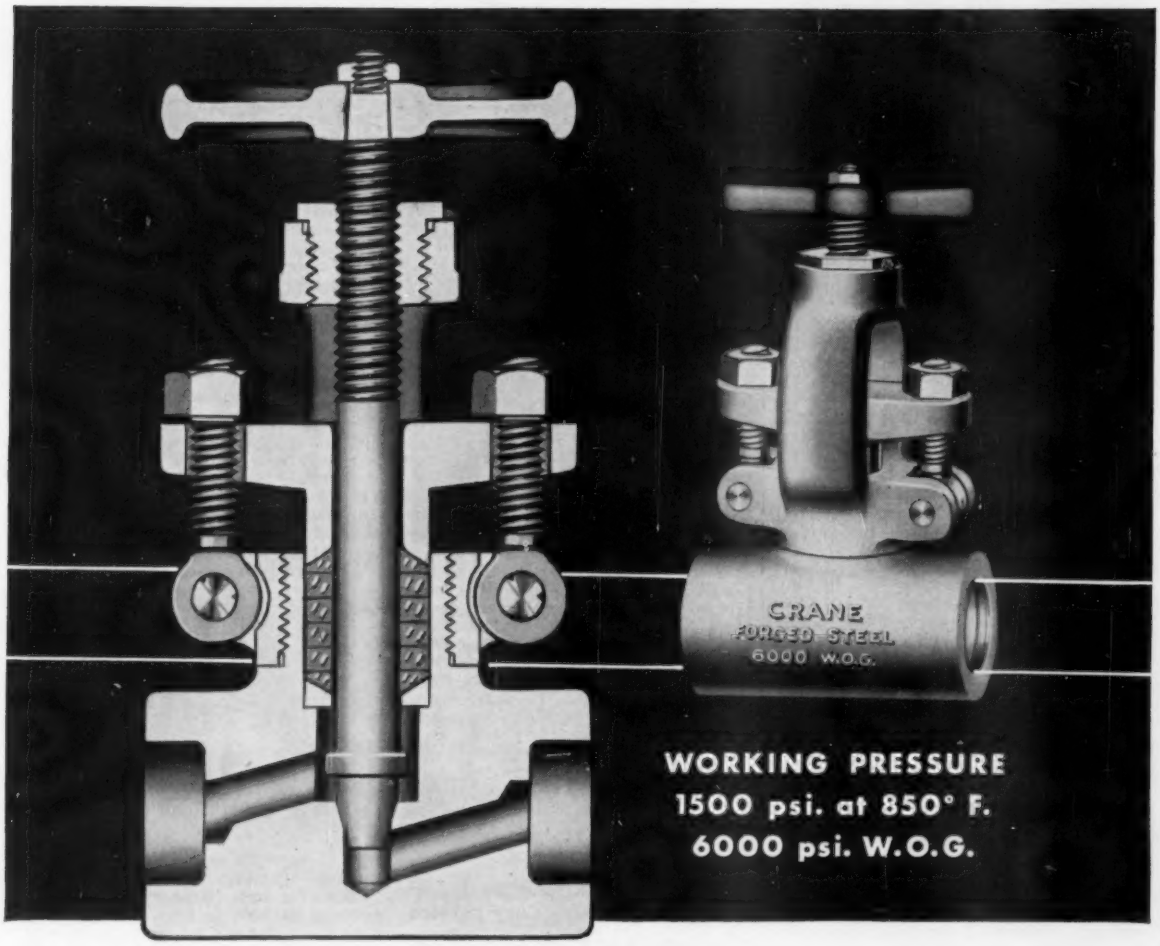
7—POWER UNIT protects against gas pressure

For controlling gas pressure build-up in supply lines, the Series R Reverse Acting Power Unit combined with manufacturer's safety shut-off valve is claimed to shut off gas supply to burner in case incoming pressure builds up beyond a predetermined safe point. These reverse acting units may be applied to all of company's Lock-Tite Valves, replacing the standard pressure operator. It is also possible to combine reverse-acting power units with standard ones to provide protection against pressure failure as well as excessive pressure build-ups. These units come in four standard tripping pressures to 10 psi. Bulletin M-302-R gives specifications. Eclipse Fuel Engineering Co.

8—TIMER VALVES control flow automatically

Flow of liquids, gas, or air can be controlled automatically with these timer valves, company reports. They consist of a solenoid valve and a timer control sealed in a water-tight case. The valves turn the flow on or off at desired time intervals. They are available in a wide

Now Available



New Crane Forged Steel Instrument Valves

Been looking for an exceptionally rugged, compact, and low-priced stop valve for your small hydraulic or high-pressure, high-temperature instrument lines?

Crane has developed it—sizes ¼", ⅜" and ½", in both screwed and socket-welded patterns. It's the all-new Crane Forged Steel Instrument Valve, and you can specify it now for immediate delivery.

Will Handle Many Services

Note closely the over-all design and construction shown above of this new Crane valve. Oversized stuffing box—heavy-duty Crane Exelloy stem with integral disc—bolted gland—swinging gland eye bolts—outside screw and yoke construction—all add up to the high performance and low maintenance you want in a valve for your instrument panels, orifice meters, bypass and gauge lines, regulator leads, and other hydraulic and high pressure temperature lines.

Literature on Request

These rugged, low-cost stop valves are built for 1500 psi. at 850° and 6000 psi. W.O.G. Construction and materials are job-engineered by Crane experts—backed by a century of quality manufacturing, matchless experience. You'll want complete information on the all-new Crane Forged Steel Instrument Valves.

For literature contact your local Crane Representative, or write to address below.

CRANE VALVES & FITTINGS

PIPE • KITCHENS • PLUMBING • HEATING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

For more data circle 542 on Post Card

variety of timing cycles, company points out, and have many industrial applications. For example, they can be used to turn a flow either on or off, or both on and then off, at any desired time. They can perform this function each day with repeat cycle operation — no re-setting is needed. Valves can be used to obtain continuously intermittent operation — that is, they can be set to open and close a valve a certain number of times per minute, hour, day. They fit standard pipe ⅜ in. and larger, and operate on 110 or 220-v, 60 cycle current. Automatic Controls Corp.

9—SOLVENT CEMENT for PVC piping systems

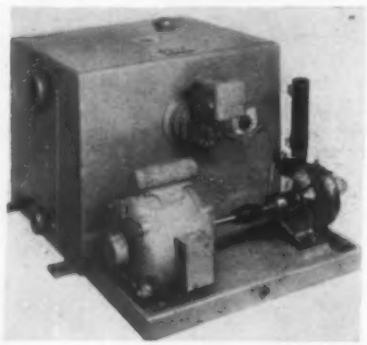
For joining polyvinyl chloride pipe fittings and flanges, this solvent cement is claimed to make possible a joint as strong as or stronger than the pipe itself, and to bridge a greater diametral gap than previously available bonding agents. It is declared simple and economical to use — a paint brush serves as the applicator. Manufacturer says a joint can be handled in 1 hr, reaches working strength in 48 hr. Tube Turns Plastics, Inc.

10—MAGNETIC BRAKE is self-adjusting type

The Type SA is a d-c magnetic brake designed to eliminate need for adjustment throughout its service life. The self-adjusting feature decreases maintenance, it is claimed, and provides longer lining and wheel life. Regardless of lining wear or wheel expansion the brake shoe remains in correct adjustment and proper alignment with the wheel, says manufacturer, and once the correct torque setting is made for a given application, it need never be changed. By not permitting shoe tips to drag, the self-aligning feature provides for even lining wear, and, according to company, in some applications increases lining life up to 50 per cent. The brake is available in sizes to fit all d-c motors. Application to a-c motors is possible through addition of rectifiers. Westinghouse Electric Corp.

11—CONDENSATE PUMP, high capacity, needs no pit

Called the Eagle, this bronze centrifugal condensate return pump does not require a pit even though return pipes are no more than a foot above floor. Pump is reported to be low in initial cost, and to have a greater capacity than many pumps at the same price. It handles any



load up to 8000 sq ft at 20 psi and features open impeller, stainless steel shaft, life-sealed ball bearing, and flexible coupling and pipe connections which isolate pump and serve to eliminate pipe cramp, wear and noise. The ¼ hp capacitor type motor has thermal overload protection. Pump also has a level indicating two-pole switch, 18½-gal steel receiver with 1 in. vent and ¾ in. drain. Walter H. Eagan Co., Inc.

12—POWDER NOZZLE permits straight cuts in concrete

With this powder nozzle it is claimed possible to cut concrete with a standard industrial powder-cutting blowpipe. Using the new nozzle, clean, straight cuts

can be made in concrete, it is announced, on both vertical and horizontal planes. In powder-cutting a metallic powder is added to the oxyacetylene cutting flame. This increases the flame temperature which, in turn, increases speed and range of cutting action. The powdered metal is injected into the flame automatically from a powder dispensing unit. Equipped with this powder nozzle, a powder-cutting blowpipe will cut cement, concrete, and reinforced concrete, says company. Cutting speeds vary according to thickness of material. Linde Air Products Co.

13—HELICAL DRIVES designed for heavy duty service

In-line helical gear drives, announced as combining a high degree of standardization with ability to stand up in heavy duty service, include double reduction drives in ratios from 6.2 to 1 through 38.4 to 1, with capacities to 118 hp, and triple reduction units in ratios from 47.1 to 1 through 292 to 1, capacities to 20 hp. These drives have one-piece cast-iron housings, with oil seals at shaft openings. To minimize space requirements and layout problems, input and output shafts are located in the same horizontal and vertical planes.

Maintenance is simplified through maximum accessibility and the fact that it is not necessary to change the low-gear set in order to alter the ratio. The drives are designed to permit addition of an integral positive-locking backstop without modification. Full information is in Book 2651. Link-Belt Co.

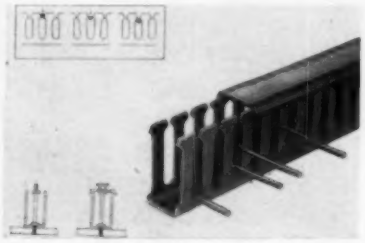
14—EXPANSION UNIONS for use in hazardous locations

This one-piece sliding sleeve expansion union is designed to compensate for conduit which has been cut too short, and at the same time eliminate the need for springing conduit to one side during installation. Made in standard (UNY and UNF) and extra long lengths (UNYL and UNFL) these condulets are smaller in diameter than conventional unions of the UNY and UNF types, and come in ½, ¾ and 1-in. sizes. Manufacturer says they are readily used where unions of larger diameter would make connection difficult.

The union is factory assembled as a one-piece union. It consists of two cylinders, one fitting inside the other. The longer union expands to compensate for errors in cutting conduit too short, and can thus be used as an extension fitting. Surfaces mate accurately, assuring a long enough contact to prevent passage of flames at full expansion, it is explained; these condulets thus meet specifications for use in hazardous areas where explosion-proof and dust-tight features are required. Also, locking and grounding springs afford positive grounding continuity. Crouse-Hinds Co.

15—CONTROL PANEL CONDUIT reduces wiring time

Featuring a slot design said to cut wiring time to a minimum, Panduit Plastic Wiring Duct is available in a wide range of sizes, the largest being 3-by-3 in. by 5 ft. The slot design introduces a simplified method of inserting and removing wires, in that the wires are merely snapped in and out of the duct. It also permits attachment of lugs before the



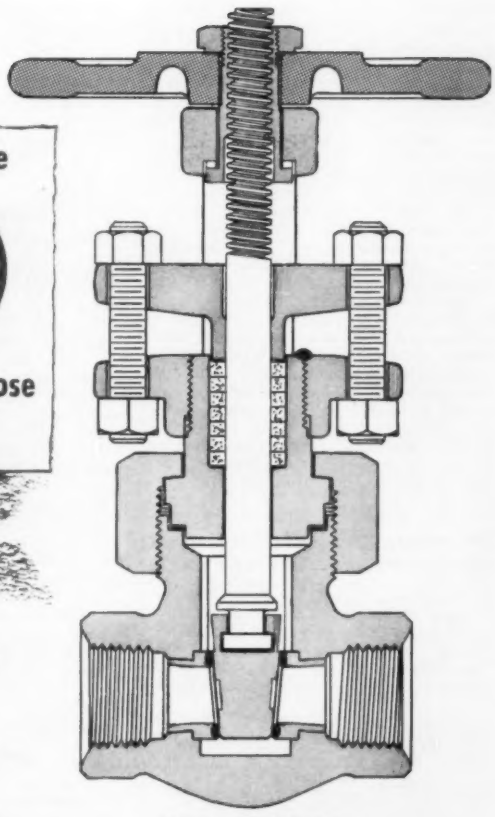
wire is inserted and lets the wire be removed with lugs attached.

The Panduit fastener is also announced as new, in that it holds both duct and cover and prevents either from slipping. Being an internal nut and bolt arrangement, it has no external projections, company explains; it does not require space adjacent to the duct and does not interfere with wire insertion, threading of wires under fasteners is eliminated. Low in initial cost, the wiring duct is highly insulating, says manufacturer, and it won't warp. Panduit Co.

16—ROBOT WEIGHMASTER for long conveyor systems

Called Electro-Way, this electronic device automatically weighs flour, coal, cement, or similar bulk goods as they pass by on the conveyor. In addition to recording quantities, it is claimed able to prevent overloads, improper blending of ingredients, and choke-ups in bagging or mixing machines. Main advantage of Electro-Way, according to manufacturer, is its accuracy despite extreme temperature variations, vibration, sudden radical changes in load, or presence of dust or dirt. It is also lighter and more compact.

Manufacturer attributes the Electro-Way's accuracy and dependability to elimination of complex beams, balances and mechanical linkages in favor of a



G-P series 5-9530

Hard faced* Seating

. . . at no extra cost!

STELLITE *faced seating surfaces* are among the many plus advantages offered by Vogt General Purpose Valves. Fusion welded to the removable stainless steel seat rings of gate valves and to the integral seat of globe and angle valve bodies, tough, long-wearing STELLITE affords amazing resistance to erosion, corrosion and galling.

The new line of Vogt drop forged steel GP's completely fills the demands of industry for a line of compact, lighter weight, shorter face-to-face valves. They assure operation economies and longer life and are available in a complete range of sizes and types from ¼" to 2". They are rated 800 pounds at 850°F. and 2,000 pounds at 100°F. Send today for free catalog.

Adv. No. 2 in a series describing the features of Vogt G-P Valves.

Write For Your FREE COPY of Supplement No. 1 to Catalog F-9, Dept. 24-FPE.

HENRY VOGT MACHINE CO.
P. O. Box 1918 • Louisville 1, Kentucky

SALES OFFICES:

New York, Philadelphia, Cleveland, Chicago, St. Louis, Charleston, W. Va., Cincinnati, Dallas, San Francisco

Vogt GENERAL PURPOSE GP Vogt FOR BETTER VALVES

DROP FORGED STEEL

VALVES

For more data circle 543 on Post Card

single large spring made of Ni-Span C (a nickel-chromium-titanium-iron alloy produced by The H. A. Wilson Co.) plus electronic connections. Described as a "constant-modulus" alloy, Ni-Span C maintains the same elasticity at all times without temperature-compensation devices. Electro-Way's pick-up consists of a set of rollers over which the loaded belt passes. The rollers, in turn, bear upon the Ni-Span C spring. A "transducer" converts the spring's mechanical motion into an electrical signal. Mounted on the conveyor frame, the weighing platform requires neither superstructure nor floor space.

Measurements are displayed on a Veeder-Root or similar counter, recorded on a 24-hr chart, or both. Electro-Way can be set so that it stops the conveyor system automatically when the counter registers a given total weight, or can be harnessed to assure delivery of no more than a specified number of pounds per hour. Power requirements are low — 115 v, 60 cycles, 100 w. Commercial Products Div., Bell Aircraft Corp.

17—GEARED JOINT transmits torque at 45- to 315-deg angles

Actually an adjustable gear box that transmits torque at any angle from 45 to 315 deg, this new geared joint has needle bearings which have increased its efficiency 60 per cent, says manufacturer. The new design is also lighter

and smaller than company's previous models having same torque capacity. This makes the unit lower in cost. Primary use for the geared joint, at present, is for making sharp bends in valve remote control linkages using flexible shafting or reach rods. To install the unit, you merely connect each end to flexible shafts or reach rods, bracket the joint in place, and then drill a spot for a set screw to keep the two halves of the joint at the proper angle. With the needle bearings the geared joint can be used for power applications with speeds to 500 rpm. Three sizes — Models 40, 60 and 250 — are offered; the largest of them has a maximum recommended operating torque of 3500 lb-in. Stow Mfg. Co.

18—ABRASIVE BLADE is faster, safer, break-resistant

With the new Tuffie Blade, every masonry material can be cut — hard or soft — with efficiency of regular blades, it is announced, but with increased safety due to special reinforcing. Reinforced throughout with tough fiber glass, the Tuffie has three-ply reinforcing around hub on both sides for two-way protection when cutting. The Tuffie features friction-free sides which add hundreds of cutting edges to each blade, it is explained, and both sides of blades are covered with raised cutting edges. These extra cutting edges cut faster, cleaner, eliminating drag, company notes — with all the power right in the cut. Tuffie is available in 12-, 14-, and 18-in. diam. Eveready BrikSaw Co.

19—TIMING MOTORS keep rate independent of load variations

Reported to provide the accuracy of an escapement clock and the power of an electric motor, these chronometrically governed d-c timing motors are designed to keep rate independent of load, line and temperature variations. Power pulses at full line voltage are applied to a small motor at intervals controlled by a jewelled escapement, with pulse duration determined by travel of motor. This method is designed to hold motor travel constant during each time interval regardless of load (within rating). As a result beat rate is held constant within ±0.1 per cent for line voltage variations of ±20 per cent and load variations from zero to full load. Standard escapements are 300-beat and 900-beat types giving 150 or 450 complete oscillations per minute. Motors are supplied in conventional form with self-contained gear reduction and output shaft. The A. W. Haydon Co.

20—CONTACT SWITCH KIT for variety of combinations

Providing components necessary for assembly of a wide variety of contact switch combinations, this kit is offered for those who plan to repair or test electrically operated controls. Kit includes compartments containing contact blades, insulators, separators, tension plates, angle brackets, side lugs, nylon lifters, contact rivets, washers, screws and bushings. Standard and midget size blades are furnished. Guardian Electric Mfg. Co.

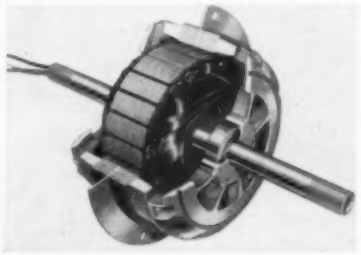
21—CONDENSATE PUMP easily converts from single to duplex

Type S Condensate Pumps are close-coupled, bronze-fitted pumps furnished with a 12-gal cast iron receiver, having a capacity from 2000 to 8000 sq ft EDR and 3450 rpm. Pumps are easy to convert from single to duplex. Features

include low 7½ in. inlet, mechanical seal and dynamically balanced enclosed bronze impeller. No sub-base is required. Pumps are easy to take apart for inspection without removing pipe connections — simply by removing 3 bolts. Bulletin 1460 gives more details. Sarco Co., Inc.

22—FHP MOTOR offers more efficiency; reduced size, weight

As pointed out by manufacturer, this fractional horsepower motor differs from conventional ones in that the rotor is on the outside and revolves around a stationary shaft and stator assembly. Lead wires pass through the hollow stationary shaft to the stator windings. Integral drive of the blower wheel is accomplished by a flange on the rotor which connects directly to wheel. Wheel and motor share a common shaft and bearings; it



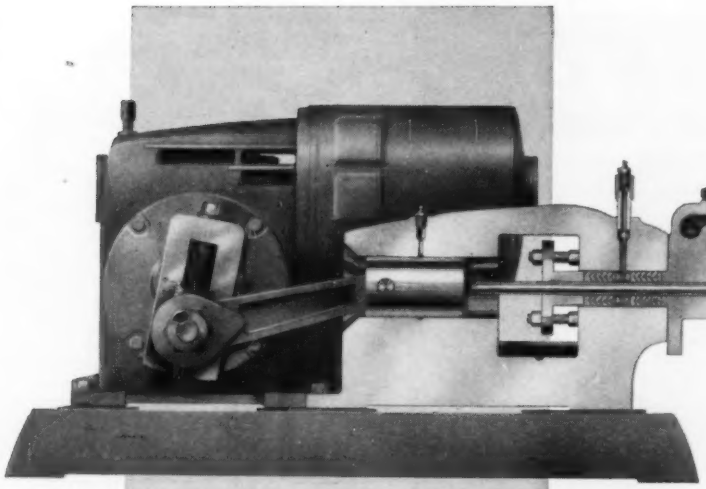
is possible to mount the motor with shaft vertical or in any other desired position. Major advantage of the design is said to be greater air delivery in relation to size, weight, power input and cost of blower-motor combination.

The motor itself is described as a six-pole permanent split capacitor type with high electrical efficiency and high power factor. Full load speed is 1050 rpm, but speed can be controlled by varying the voltage. First production models are rated at ¼ hp. Weight is 12½ lb; diameter, 6 in.; width, 4⅝ in. Noteworthy in design is the ventilation principle whereby fan blades are integrally cast with end shields, which rotate with the external rotor. Air is drawn into each end of the motor through holes near the shaft. Vanes on the inside of the spinning end shields impart a whirling motion to the air — directing it over stator windings and expelling it through slots in the periphery of the motor. Cooling air thus is not pulled through the precision air gap or other restricted passages within the motor, it is explained. Electronics Div., Iron Fireman Mfg. Co.

23—REFRIGERATING MACHINE, single-stage, centrifugal type

Features announced for the Tonrac, a single-stage hermetic centrifugal refrigerating machine, are quieter, more efficient performance, and automatic chilled-water temperature control. Machines are now available for a range of 240 to 410 tons. Motor ratings are 250 and 300 hp, both suitable for 115 per cent of rated continuous duty. Hermetic motors are available for 208, 220, 240, 440, 460, 480, and 550 v; three-phase, 60 cycles, three-wire, and two-phase, 60 cycles, four-wire current. Reduced voltage starting equipment is required.

According to manufacturer, Tonrac's single-stage design contributes to operating efficiency through elimination of two or more compression stages combined with improved diffusion in the volute casing. This compact construction avoids extra impellers, housings and connections, it is pointed out, and saves space and weight. Tonrac can be installed anywhere in a building, from basement to roof; the only requirement is that the supporting structure be cap-

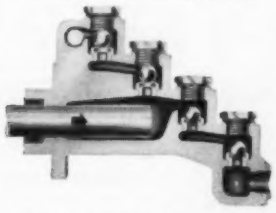


Standard Milton Roy motor-driven controlled volume pump.

• Wear on all moving parts minimized by close tolerance machining of cross-head, pump frames and liquid end parts. • Excessive packing wear avoided by large length-to-diameter ratio of cross-head which fully supports plunger. • Long service life under shock and oscillating loads assured by generously-sized reducer and connecting rod bearings.

Dependability for metering process additives

Exclusive Milton Roy
STEP-VALVE LIQUID END



Double ball checks, sloping passages and absence of air pockets assure highest possible volumetric efficiency. Should a solid particle lodge under one suction ball, for example, second suction ball will seat on discharge stroke, thereby preventing fluid from being pumped into suction piping.

MILTON ROY dependability means long service life in your controlled volume pump . . . minimum maintenance . . . lower operating cost.

Here's why. Designed-in dependability is the result of extreme care in the sizing of motor horsepower, reducer torque and overhung load capacity. Reducer, motor and pump mounting pads on a rigid, webbed base are precision machined to assure perfect alignment of the entire assembly . . . and of all moving parts.

Specify Milton Roy . . . your guarantee of dependability in controlled volume pumps and complete chemical feed systems. A practical solution to your metering problem will be found in one of the following bulletins. Write for your copy today.

Bulletin 455 "Controlled Volume Pumps in Paper Making."

Bulletin 953 "Controlled Volume Pumps in Industrial Water Treating."

Bulletin 1253 "Controlled Volume Pumps in Process Instrumentation."

Milton Roy Company, *Manufacturing Engineers*, 1300 East Mermaid Lane, Philadelphia 18, Pa.

Engineering Representatives in the United States, Canada, Mexico, Europe, Asia, South America and Africa.

milton Roy
CHEMICAL FEED SYSTEMS

For more data circle 544 on Post Card

BIDDLE *Instrument News*

IT TAKES ONLY ONE STRIKE

. . . to knock out important electrical equipment

The season for electrical storms will soon be with us again in many sections of the country. The insidious thing about lightning is that it strikes at your plant's power system. Nine-tenths of the industrial damage it causes is to vital electrical equipment—motors, generators, transformers—or to power house chimneys. But this damage is of small consequence compared to the loss of power and stoppage of production. To prevent such losses, ground connections on lightning rods and arresters must be kept in good condition.

Test Grounds Once a Year

Properly installed and grounded lightning arresters are the first line of defense in protecting important electrical equipment such as generators, switchboards and transformers from lightning damage. Similarly, factory stacks are less subject to damage if protected by lightning rods and conductors that permit the stroke to pass harmlessly to earth.

In spite of apparently good lightning rod or arrester protection, lightning frequently will cause severe damage if high ground resistance hampers its dissipation in the earth.

Experience has shown that ground resistance does not remain constant and that tests should be made at least once a year, and high ground resistance corrected.

"Megger" Method

This is the simplest, easiest, quickest and most accurate method of determining ground resistance, and should be used wherever possible. The "Megger"® Ground Tester is an instrument specially designed for this purpose.

By virtue of the Megger crossed-coil ohmmeter the Megger Ground Testers are *direct-reading* in ohms. The operator reads the resistance value from the deflection of a pointer over a scale, as simply and easily as reading a voltmeter. These results are secured with only *one set of connections*, in *one operation*, and *without any calculations*.

For measurements of ordinary ground resistance, two auxiliary or reference grounds are required; or, connection may be made to a water system or other metallic structure that is known or assumed to have zero resistance to earth. The ohmmeter then indicates the resistance to earth of the ground under test.

Resistance of Grounds Should Not Exceed 5 Ohms

If tests show the resistance to ground is over 5 ohms, the resistance should be reduced by connecting to underground water pipes, copper plates or driven rods.

Want Help on Grounding Problems?

Write for these bulletins:

Bulletin 25-J-PE—A Manual on Ground Resistance Testing.

Bulletin 25T2PE—"Grounding Electric Circuits Effectively"

Bulletin 25T4PE—"Grounding Principles and Practices as Applied to Industrial Plants" B-604

JAMES G. BIDDLE CO.

• ELECTRICAL TESTING INSTRUMENTS
• SPEED MEASURING INSTRUMENTS
• LABORATORY & SCIENTIFIC EQUIPMENT

1316 ARCH STREET
PHILADELPHIA 7, PA.

For more data circle 545 on Post Card

able of carrying the unit's dead weight.

Hermetic construction in this refrigerating machine provides complete enclosure of motor-compressor assembly. No mechanical shaft seals are required, it is noted. Refrigerant is Freon 113, used because of its safety advantages and its stability in withstanding repeated evaporations, compressions and condensations without disassociation. American Blower Corp.

24—VALVE for high pressures, high temperatures

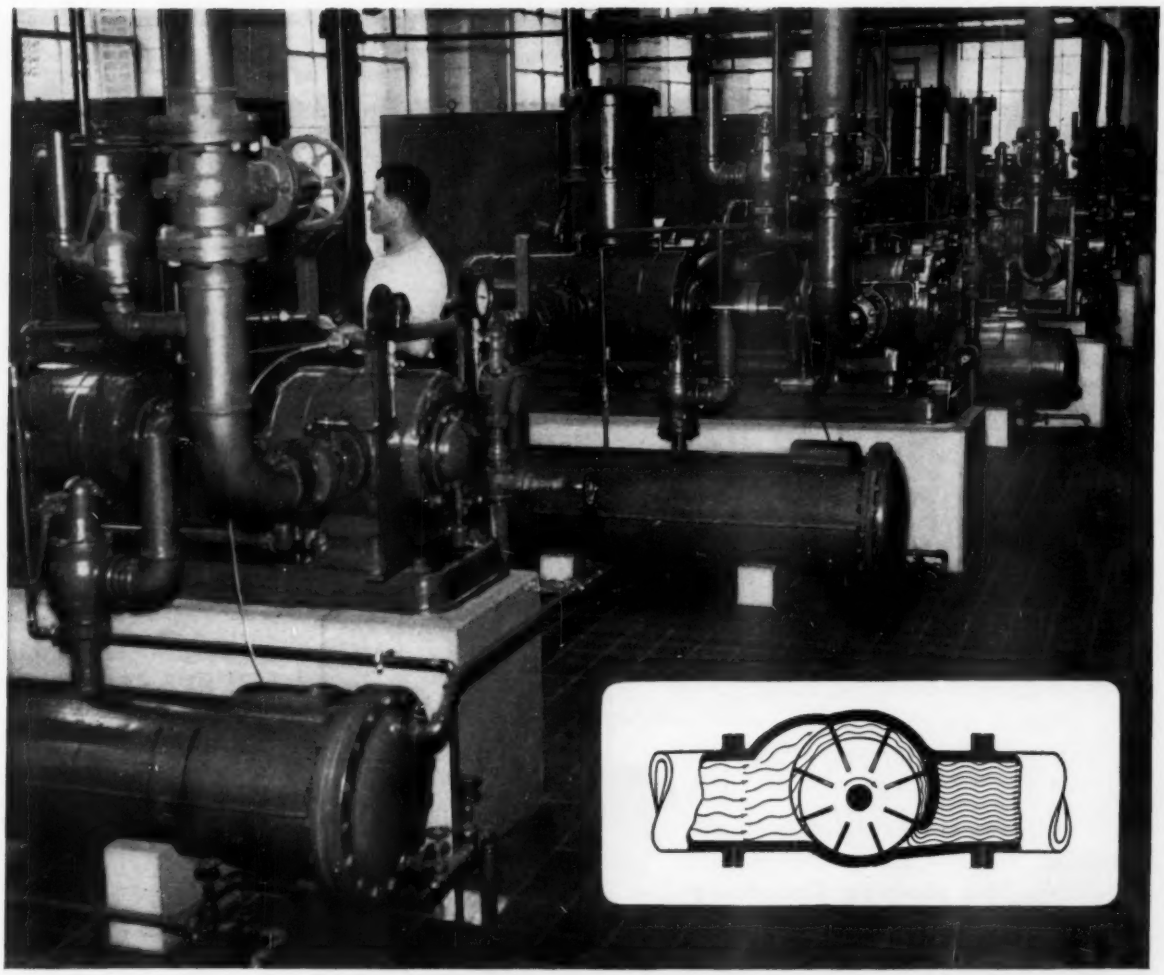
Welbond Valves are suggested for general boiler room use including drain service on water wall headers, economizers, water columns and gages; drain and vent services on superheaters and steam

lines; shut-off service on sampling lines, bypasses, water gages, water columns and instruments. Valves feature a compact design and materials selected to resist high pressure, high temperature service. Integral seat of heavy stellite is welded on the seat nozzle and finished before the nozzle is welded to the body. An annular groove is incorporated to absorb thermal changes near the seat, prevent distortion during assembly welding, and permit a positive seal when the valve is closed. Welbond valves are available in seven sizes from ½ to 2½ in., angle and straightway patterns, socket weld ends, and for pressures, 1,500 and 2,500 psi at 1050 F. Yarnall-Waring Co.

25—RECORDERS, graphic-type electronic units

American-Microsen Series 130 Electronic Recorders are designed in graphic style, recording on a 3-in. wide chart while using panel space less than 25 sq in. Both continuous strip charts and IBM card charts are available. Recording is on straight-line coordinates. The recorder measures input signals with an electro-mechanical transducer and amplifier which drives a rotary solenoid to position the pen. A feedback spring from the pen arm to the input transducer force balances the pen position in precise relationship with the input signal. The resulting power is claimed to eliminate pivot friction errors, vibration effects and excessive maintenance.

Recorders are available as microammeters in ranges from 0–200 microamperes to 0–100 milliamperes; and as millivoltmeters in ranges from 0–20 mv to 0–100 v with input sensitivity to 6700 ohms per volt. Accuracy is given as within 0.5 per cent of range, and repeat-



Industrial Pressures Up To 125 psig
Capacities to 3300 cfm

When you need such performance, it will pay you to specify Fuller vane-type Rotary Compressors. They provide the simplest, most economical and most reliable source of compressed air for all pneumatic plant services.

These compressors have a minimum number of moving parts, (rotor, blades and bearings) employ direct-connected motor drive, and operate with an incredible lack of vibration. They run for days without requiring operational attention, and are ideal for continuous service in out-of-the-way locations.

Detailed information on design characteristics, and typical applications will be forwarded promptly on request.

Fuller
. . . . pioneers in harnessing AIR

FULLER COMPANY, 150 Bridge St., Catasauqua, Pa.
GENERAL AMERICAN TRANSPORTATION CORPORATION SUBSIDIARY
Chicago • San Francisco • Los Angeles • Seattle • Birmingham

C-269
1954

For more data circle 546 on Post Card

There is every reason—
and now is the season—to

TEST YOUR TOWER

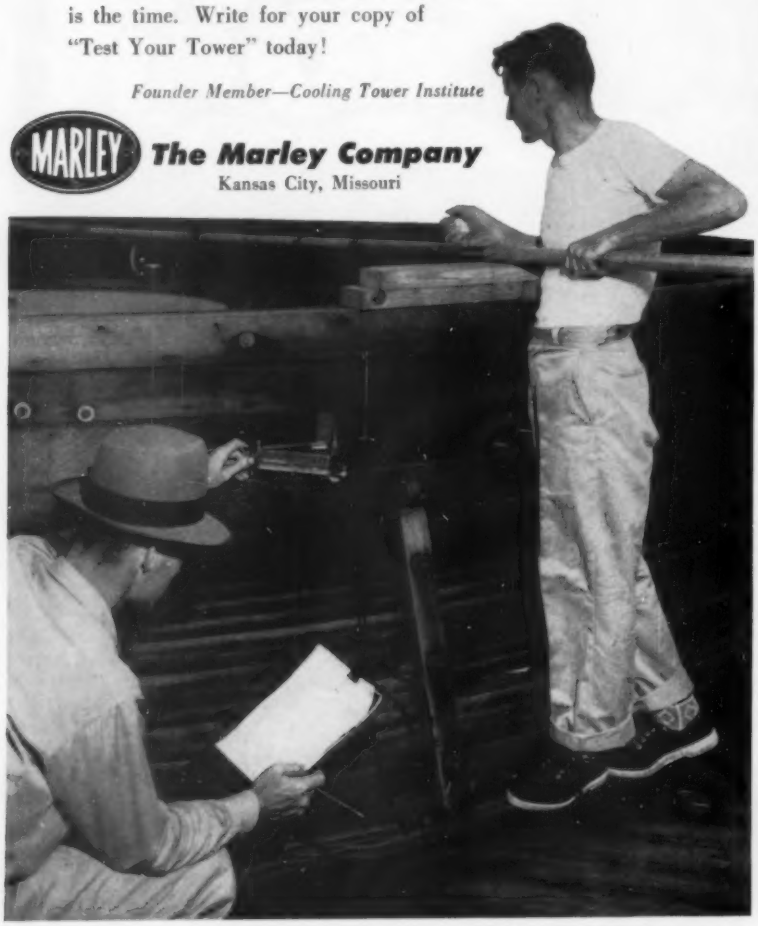
Thanks largely to Marley's "Test Your Tower" crusade, it is generally accepted today that the purchaser of a cooling tower is entitled to proof of positive performance. Only a test is proof positive—and the best season of the year for tower testing is at hand.

So if you haven't done so already, write today for Marley's technical bulletin, "Test Your Tower". It offers a simple, proven method by which you can determine how closely your actual tower performance measures up to specified performance. Such information is well worth knowing, particularly in those industries where the whole tempo of operations is closely geared to temperature of process cooling water. Knowing your tower's capabilities and limitations will also help you make sound plans for the future if you have purchased a tower with plant expansion in mind.

Whatever your situation, it pays to test, and now is the time. Write for your copy of "Test Your Tower" today!

Founder Member—Cooling Tower Institute

MARLEY **The Marley Company**
Kansas City, Missouri



For more data circle 547 on Post Card

ability as better than 0.25 per cent. The recorders are designed to respond to input changes of less than 0.2 per cent of range. They can be furnished with single high or low, or high and low alarm contacts. Industrial Controls Div., Manning, Maxwell & Moore, Inc.

26—RECEIVER PURIFIER for making exhaust steam reusable

For purifying exhaust steam so that it can be reused for heat exchangers, unit heaters, or for heating or condensate, this receiver-type Hi-eF Purifier is designed for installation in exhaust steam lines from steam hammers, reciprocating engines and other steam equipment. Condensate, oil droplets and other mist entrainment is intercepted from exhaust steam by means of a two-stage principle of separation. In the first stage, the velocity of the exhaust steam is suddenly reduced as it enters the receiver drum. This serves to drop out the larger droplets of condensate and other material. Then the exhaust steam is guided through a multi-stage separating element which removes fine mist by controlled centrifugal action. The V. D. Anderson Co.

27—TUBULAR FILTER incorporates self-cleaning feature

Useful for water or chemical purification, the Hydra-Shoc builds up air pressure at the end of the filtering cycle and uses the pressure for a sudden back-surge to clean the filter. No extra devices are used, the filter shell itself acts as the pressure chamber and the arrangement of regular valving provides the controls. Neither filtered water for cleaning nor back flow pumps are needed. Operating vertically, this tubular filter takes little floor space, and it is reported to provide filtration at a relatively low price.

In the Hydra-Shoc, influent passes through the walls of perforated tubes covered with synthetic fabrics. The cleaning procedure is simple. The outlet valve is closed, building up pressure on the entrapped air. Then a pair of quick opening valves shut off the inlet and open the drain. The compressed air causes a violent back surge that expands the tube covers, dislodges the filter cake and forces it out the drain in seconds. Bulletin 114 describes this filter. Industrial Filter and Pump Mfg. Co.

28—DIAPHRAGM PUMP solves many de-watering problems

For heavy-duty pumping — mud, sand and sewage — the Model 20DP3 has a pumping capacity of 5000 gph. It weighs only 120 lb and its compact design permits setting up pumping operations quickly and in any location. Also, company points out, it is economical to operate; it runs 6 hr at full capacity on a gallon of fuel. Powered by a single-cylinder, two-cycle gasoline engine, the Model 20DP3 operates at engine speeds between 1500 and 2850 rpm. The throttle on the float-type carburetor can be hand-regulated to adjust engine speed for different pumping conditions. The pump is self priming; it is claimed to dry-prime up to 15 ft in 15 sec. Capacity is 5000 gph; suction lift is 28 ft; total head is 50 ft. Homelite.

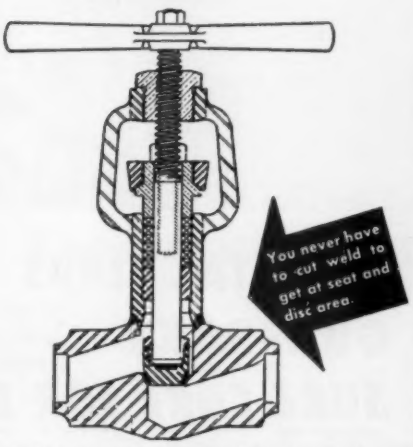
more Equipment News page 126

Cut valve maintenance up to 75%

Install HANCOCK 1500# and 2500# Steel Valves

• Every power plant maintenance man will agree that a lot of valuable time is lost when hours must be spent in servicing a single high pressure valve. That is why Hancock 1500# and 2500# Steel Valves are preferred for high-temperature steam lines. They rarely require attention, but when maintenance is needed, the work takes as little as one-fourth the time ordinary high pressure valves demand. Hancock Valves stay in the line for servicing. There is no danger of ruining internal parts. The bonnet weld is permanent—never has to be cut to get at the seat and disc area.

Most design and operating engineers in modern steam plants specify these high pressure Hancock Valves with maintenance requirements in mind. There is no bonnet joint to leak, no gasket to leak, no seat insert to leak! In design, in quality, in construction—in every respect—Hancock 1500# and 2500# Steel Valves have every feature essential to protect personnel, plant and service to customers. So, when you replace high pressure valves, remember that *when Hancocks go in, valve costs go down!*



SIZES: ¼" through 2". Outside screw and yoke.

SERVICE RATINGS: Screwed and socket weld ends: For all pressures up to 2500 psi at 1050° F., O.W.G. 6000 psi—100° F.

Flanged Ends: For all pressures up to 1500 psi at 900° F., O.W.G. 3600 psi—100° F.

Integral hard faced seats, hard faced discs.

CALL YOUR INDUSTRIAL SUPPLY DISTRIBUTOR for help in meeting your needs for revalving projects and new construction. You can depend on his recommendation to save you time, trouble and expense.

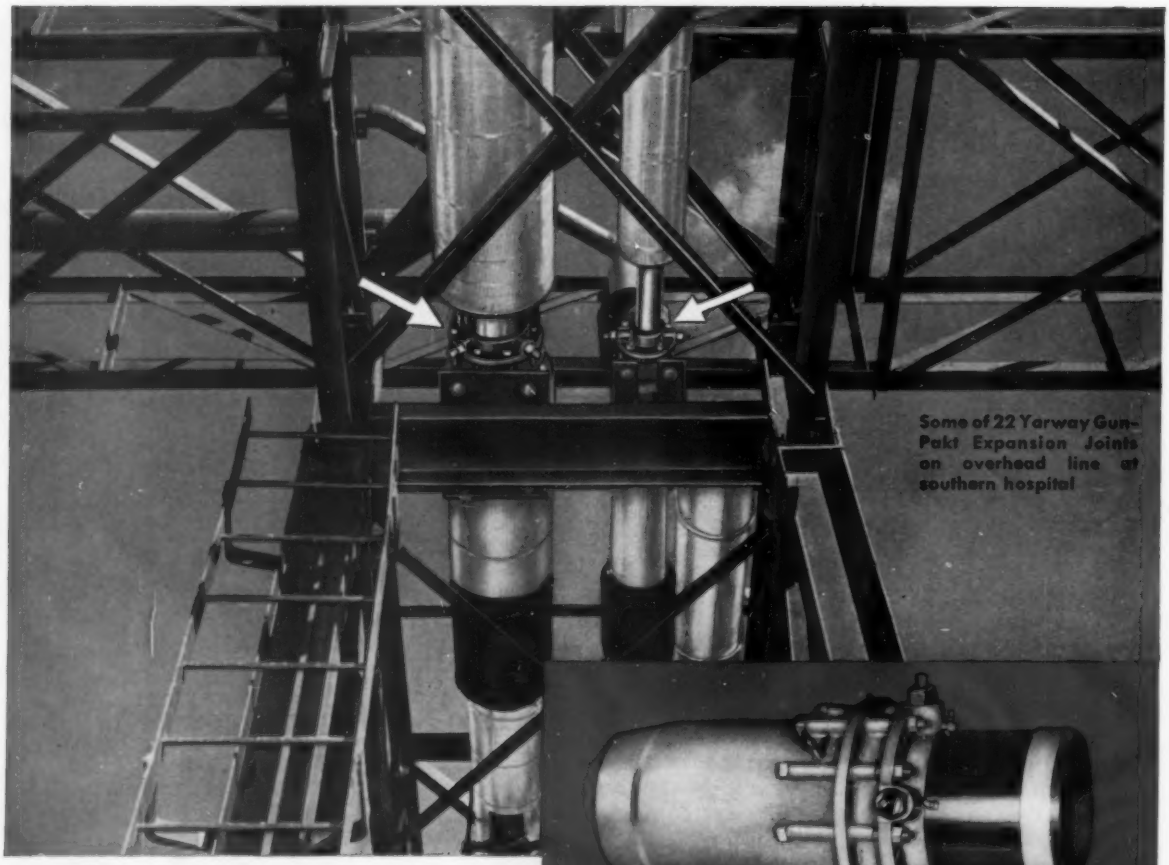
In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

HANCOCK VALVES

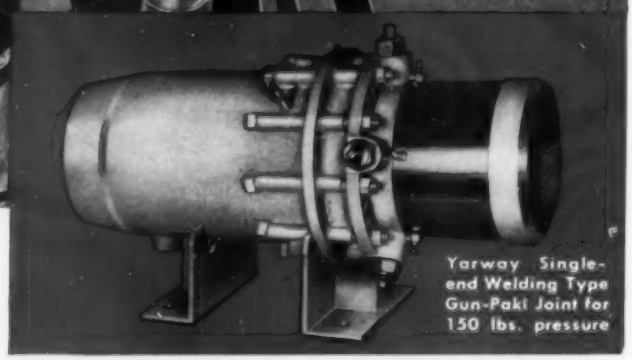
A product of **MANNING, MAXWELL & MOORE, INC.** Watertown 72, Massachusetts

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Oklahoma.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

For more data circle 548 on Post Card



Some of 22 Yarway Gun-Pakt Expansion Joints on overhead line at southern hospital



Yarway Single-end Welding Type Gun-Pakt Joint for 150 lbs. pressure

HOSPITAL FINDS GUN-PAKT *SURE CURE FOR EXPANSION JOINT TROUBLES*

YARWAY Gun-Pakt Expansion Joints are just what the "doctor" ordered for this overhead steam line at a large southern hospital—and he ordered 22 of them!

In institutions, industrial plants and other large steam distributor systems YARWAY Gun-Pakt Joints are growing in popularity.

YARWAY Gun-Pakt slip-type joints give long life—no fatigue failures.

You need *fewer joints per length of line*, with traverses up to 12″ single and 24″ double.

With Gun-Pakt joints packing may be added as necessary, *under full steam pressure right on the job—no unpacking, no shutdowns.*

There's also *lower pressure load on end anchors* because excessive strains are eliminated.

All these are reasons why it will pay you to "do as the doctor ordered"—look into YARWAY Gun-Pakt Expansion Joints. Write for Bulletin EJ-1914.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
Branch Offices in Principal Cities

YARWAY **GUN-PAKT EXPANSION JOINTS**

For more data circle 549 on Post Card

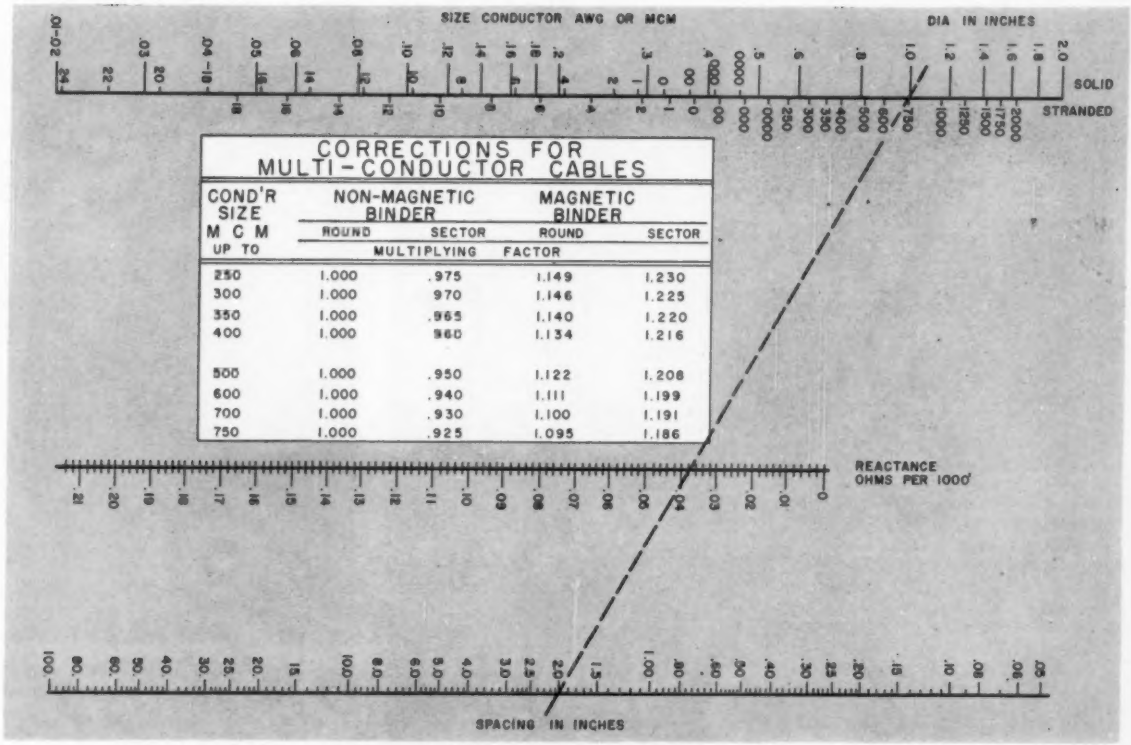


Fig. 1. Chart gives the series inductive reactance to neutral for various conductor sizes, spacings and arrangements. The equivalent spacing is obtained from Fig. 2

Conductor Reactance Chart

Here's a quick and convenient method of finding conductor reactances. It's good for bare conductors in the open or for single and multiple cables in conduit with magnetic or non-magnetic binders

HOW TO USE THE CHART

Submitted by R. R. Taggs

DETERMINE the equivalent spacing "S" as shown in Fig. 2.

Then turn to Fig. 1 and run a straight edge between this value of spacing and the size of the conductor.

Note where the straight edge cuts the reactance scale. Then apply corrections.

Correction for single conductors in conduit:

Non-magnetic — increase 20 per cent for random lay.

Magnetic — increase 50 per cent for magnetic effect and random lay.

Multiple cables in conduit:

Non-magnetic — no correction.

Magnetic — Use value for round conductors with magnetic binder (See correction table Fig. 1).

Example: Find reactance of three single conductor, 750 MCM cables in magnetic conduit. Cable outside diam is 2 in.

Cables are assumed to be touching and spaced as an equilateral triangle, so the equivalent spacing, from Fig. 2, is 2 in.

Lay a straight edge between 2 in. in the spacing column of Fig. 1 and 750 MCM in the conductor size column. This line gives a reactance of 0.38 ohms per 1000 ft.

This value of reactance must then be increased by a factor of 1.5 since the cable is in magnetic conduit, giving a final reactance of 0.057 ohms per 1000 ft.

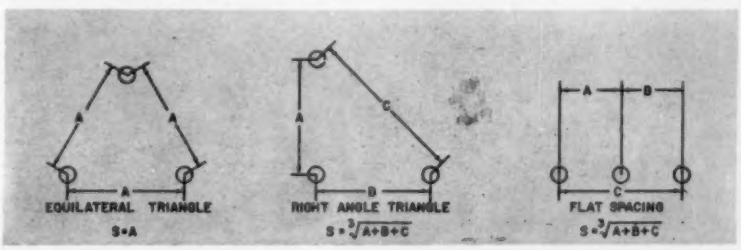


Fig. 2. Values of equivalent spacing for the more usual conductor arrangements

IN CHICAGO'S LOOP . . . .

People's Gas Building Gets Air Conditioning— Guess What System They Use!

Fig. 1. An 82,500 lb/hr boiler plant is fitted into basement to heat or cool

WHEN IT was decided that the People's Gas Building, on the edge of Chicago's Loop, was to be air-conditioned, the principals involved in the decision saw that this was an excellent opportunity to practice what they preached. Gas utilities have long advocated the use of gas-powered air conditioning systems to smooth out their seasonal load fluctuations. Many electric utilities have indicated partial agreement with this idea since too much electrical air conditioning would impose a similar seasonal inactivity on generating equipment added to meet summer peaks. Gas air conditioning would still require the electric blowers used in winter heating, so this load would become a year-around base load.

In 1949, three compact Babcock & Wilcox boilers were installed in the building basement. Each is rated at 375 hp, 125 psig (saturated steam) and is fired, surprisingly enough, exclusively with gas. These boilers each evaporate 27,500 lb steam per hr.

The building heating load can be met with two boilers idling, so metered surplus steam is sold to the Illinois Maintenance Co. for distribution to other Loop buildings. Little or no condensate is returned from outside the building, hence a heavy make-up is necessary. This is supplied by treating city water with zeolite softeners.

A unique dual-duct, single-fan ventilating system heats and cools the office space from fan rooms located on every other floor in the building. This system provides for a supply of cold air and a supply of hot air ducted separately to mixing boxes outside each office area. Temperature controls in each office vary the proportion of hot-to-cold air extracted from the main ducts for mixing and distribution to individual outlets. Steam radiators can provide supplementary space heating on those days when heat requirements exceed the capabilities of the warm air system.

This system (see Fig. 7) fits in nicely with the long-range air conditioning plans. In 1953, the first step was taken toward central air conditioning with the installation of a 500-ton capacity water chiller. The steam-turbine-driven refrigeration system supplies water at 42 F to the dual-duct system when cooling is necessary. Though the capacity of this unit was far below that needed for the entire building, it was more than adequate for the limited space needing cooling at that particular time.

A single 500-ton capacity cooling tower cell mounted on the roof, 21 floors above, provides circulating water for the refrigerating unit's condenser and for the steam turbine's condenser. The 85 F water gains 10 deg F in passing through the steam condenser and another 10 deg F passing through the chiller, then returns to the cooling tower at about 105 F. Cooling tower make-up, as with the boiler make-up, comes from the city water mains.

The first refrigeration unit installed was a Worthington machine

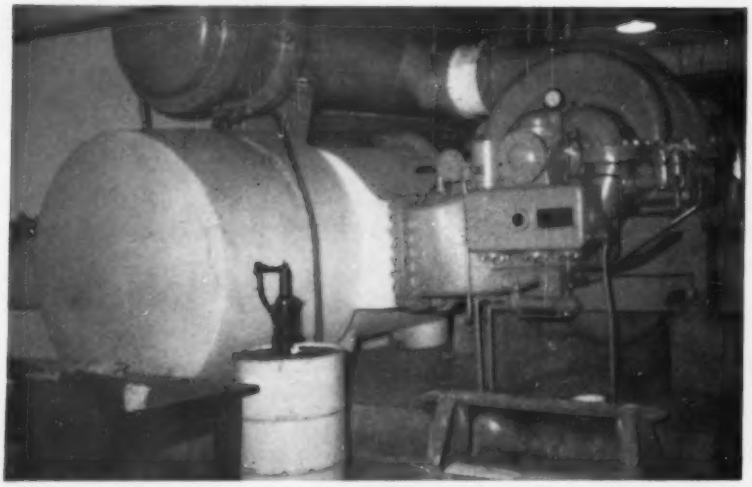


Fig. 2. This 500-ton Worthington water-chiller, driven by a Murray steam turbine, supplies 45 F water to the fan rooms on every other floor of the office building

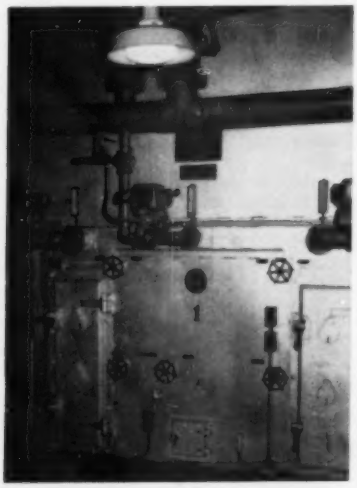


Fig. 3. Gas firing makes for compact, neat-appearing and clean boiler room

Fig. 4. S. J. Standlee, building engineer, is responsible for the new system

driven by a condensing Murray steam turbine. Inlet steam is about 125 psig saturated and the condenser pulls about 25–26 in. Hg vacuum. The second unit, to be in service for the coming summer season, is a Carrier 1000-ton machine driven by a Terry condensing turbine. Two more 500-ton cooling tower cells are being installed on the roof to handle the additional load.

When the new unit goes on the line this summer, 20 floors of the building will be air conditioned. Part of the basement space will be cooled, but the top (21st) floor will not. This space is for storage and utility purposes.

A recreation room in the basement will be cooled primarily with electric machines. Two Frick units will keep this area at 72–74 F. Another 31.5 tons of electrical capacity will provide supplementary cooling in the 5th-floor billing machine room because of the large heat loss from these electronic units. This load is being carried by seven package units rated from 3½ to 7 tons each.

Expected steam consumption, based on experience and design data, is about 16–17 lb steam per ton of refrigeration. If this consumption proves out, only one of the three boilers need be operated in summer.

With new building in the Loop area at its fastest pace in a generation, it is likely that many older buildings there will have to add air conditioning to keep tenants. If the People's Gas Building installation proves economically satisfactory, it should encourage others to take the step — with steam.

Fig. 5. Space limitations are apparent in this view across top of boilers from a catwalk. The sedate lobby of P.G. Building is about 10 ft above safety valves

Fig. 6. Even lighting, good use of color overcome lack of windows in boiler room

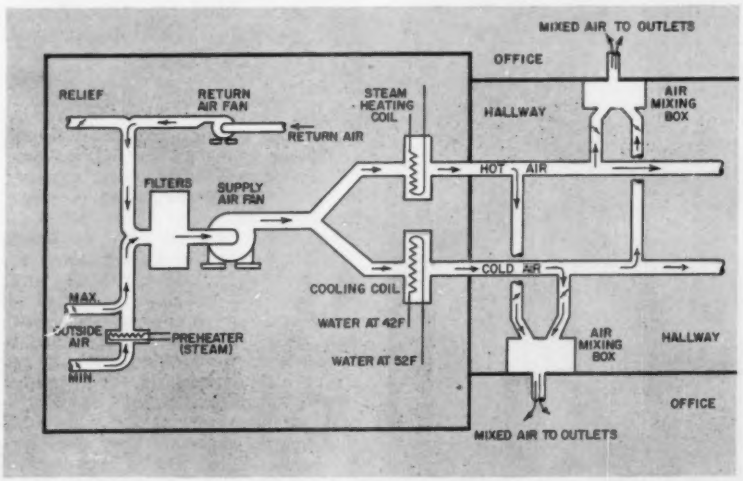
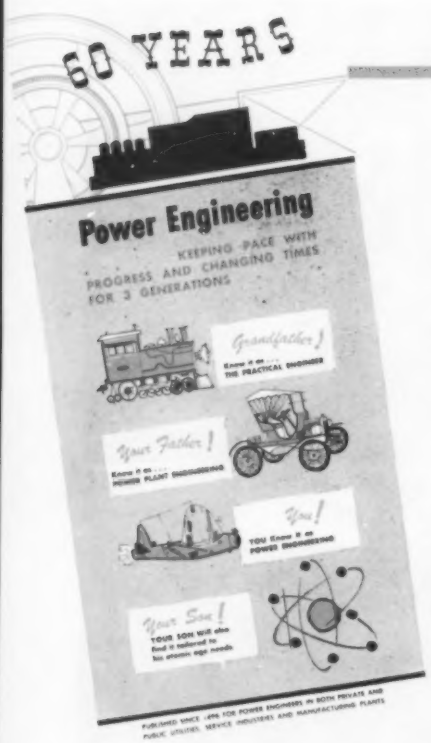


Fig. 7. Twin-duct, single-fan ventilation system provides steam-heated or water-cooled air stream to mix with fresh and recirculated air for each office's needs

Sixty Years With



POWER ENGINEERING magazine had its origin in 1896 when *The Practical Engineer* was started in Philadelphia as the official journal of the American Order of Steam Engineers. In 1908 this publication was purchased and brought to Chicago by the three men who founded Technical Publishing Co. at that time.

During the first ten years of its ownership by Technical Publishing Co., from 1908 to 1918, great strides were made in the size, character, and influence of the paper. These were the days of *steam engineering* but electricity was becoming more important. Power engineers were emerging from the mechanic class to more of a professional class. Their daily engineering problems were becoming more complex and technical, requiring more education, background, and technical experience. In its editorial treatment the *Practical Engineer* had kept ahead of these developments, so in 1918 it was decided to change the name of the paper to better express its editorial scope. The name was changed at that time to *Power Plant Engineering*, a name it retained for 30 years. Again, in 1950, to better suit the name of the paper to the expanding scope of the power industry, the name was changed to the present POWER ENGINEERING.

To give the present generation of engineers a glimpse of the state of the art of steam engineering a half century or more ago, what engineers were thinking about, and how POWER ENGINEERING has kept pace with the field over the years, the editors have prepared a little booklet describing these 60 years of POWER ENGINEERING'S progress. This booklet will be sent free to any reader requesting it as indicated in the note at the end of this article.

Compared with present-day standards, the needs and interests of the early power engineers were very simple, yet to them everything was new and complex, and their problems were as formidable and hard to solve as ours are today.

Their Corliss and their slide-valve engines, their primitive mechanical stokers — in the few cases where they had them — their "boiler compounds" and belt dressings presented as many headaches as do our high-pressure boilers and turbine-generators today; more in fact, because today we have many more basic data concerning the design and operation of all our high-powered equipment. Boilers exploded with tragic regularity and cylinder heads *let go* more frequently than was pleasant.

Engineers worked hard 60 years ago. They were at the plant early and late and they put in much time Sundays and holidays overhauling equipment and polishing brasswork. And yet they had fun. They seem to have gotten more *kick* out of running their plants than operators do today. Often, too, they were men of importance in their community. They had dignity. As *engineers* they occupied a position in society that accorded them respect and a degree of envy; they knew about dynamos and arc-lamps — mysterious things to the average citizen — and this knowledge gave them prestige.

Nearly all belonged to some fraternal order — some engineering brotherhood — and they assembled often and enthusiastically to discuss their mutual problems, to visit, eat, and drink with each other.

Some of the finest power plants in those early days were those serving breweries. These always had refrigerating equipment of considerable size, and aside from the mechanical interest which they afforded, there was always an opportunity to test samples of the product. The "brothers," therefore, made frequent inspections of these plants.

Fig. 2 The brewery plants offered opportunity to sample the product

Much of the early material in the early issues of the *Practical Engineer* was devoted to methods of setting valves and keeping engines in efficient operation. There was also considerable *educational* material — courses in simple mathematics, in physics, and elementary electricity. This was in the days before engineering colleges and few of the men employed in power plants knew anything about higher mathematics. Even such simple things as long and short division were explained in great detail.

Fig. 1 Switchboards were fearful and wonderful contraptions 60 years ago

Fig. 3 Engineers had dignity. A picture of Chief Engineer Asa Hyde, in his office

Sixty years ago, in most power plants, steam was generated in horizontal return tubular boilers, Scotch boilers, and in some cases by vertical fire-tube boilers such as the Manning and the Wickes type. Fire-tube boilers were usually of 100 to 150 horsepower capacity and, of course, were almost always set entirely too low, with brick settings of small dimensions. Coal and ash were handled by

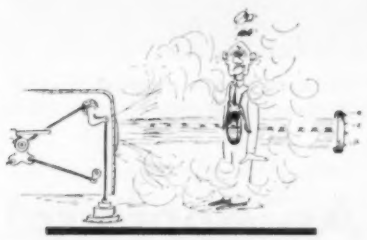


Fig. 4 Cylinder heads failed to stay put

hand and moved by small tram cars or wheelbarrows. Labor-saving equipment, such as conveyors, was virtually non-existent because labor and fuel were relatively inexpensive.

Electrical systems were primitive. Switchboards were fearful and wonderful contraptions three generations ago for they were all arrayed with exposed knife switches and, often, with even the bus bars mounted on the front of the board ready to electrocute the unwary operators.

Meters were large and crudely constructed, open fuses were on hand to blow at any time. Steel enclosed circuit breakers and all the modern devices for controlling electrical circuits were a long time in coming. Steel enclosed electrical equipment was practically unknown and as late as 1925 bare bus bars and connecting copper behind switchboard panels was the rule. Many of the metropolitan areas were served by direct current systems involving very large storage batteries. For street lighting series arc lights were almost universal.

But gradually the picture changed. After the first World War there was a decided change in the generation of power both in central stations and in industrial plants. The steam turbine had come into use and while there were still many reciprocating engines in use they were gradually being replaced by the turbine in the central stations. In the meantime, also, the chain-grate stoker had come into use together with a certain amount of conveying equipment. Boiler rooms, however, were still dirty, dusty places.

After the first World War, temperatures and pressures of steam began to rise, first to 350 and 400 psi, later to 500 and 600 psi. In 1928 *Power Plant Engineering* reported one station with a steam pressure of 1415 psi. This was the Edgar Station in Boston. From that time on there was a gradual trend toward the use of pressures in the 1200 to 1800 psi range.

Despite the steady trend towards the use of pulverized coal in the twenties, in 1928 at least 50 per cent of the new stations still used stokers of one type or another. These were the years of great electric utility expansion, and the construction of larger generating stations went hand in hand with the extension of electric transmission systems.

It is a far cry from the hand-fired boilers and slide-valve engines of three generations ago to the 5000 psi boilers and sleek 200,000-kw generators of today but the power engineer's problems, basically, are still the same — the production of the maximum amount of power from the minimum amount of fuel. Today, however, we have the atom and we are looking forward to a completely new era in power development. While

Fig. 5 And now we have the atom. Dedication of G-E's atomic power plant at West Milton, N. Y., July 18, 1955.

no nuclear power plants are yet in operation in this country there is little question concerning the future use of this new energy source. The demand for electric power is growing at such a tremendous rate that by the year 2000, it is quite probable that the installed electric generating capacity of the U. S. will have to be somewhere in the neighborhood of *two billion kilowatts*. This is 20 times as much generating capacity as we have today, and in terms of future technical development it means only one thing — ATOMIC POWER. The reason for going to atomic power is not that it will be cheaper to produce than power from coal or oil but because our nuclear energy resources are so much greater than our coal, oil, and gas reserves. The uranium reserves of the world are estimated to contain some 20 to 30 times as much energy as is contained in the existing fossil fuel reserves.

In the three generations that POWER ENGINEERING has been in existence, the industry has grown from virtually nothing to the vast complex it is today. It is remarkable that all this should have taken place in one person's lifetime. There is little doubt that the years to come will see even far greater development but as it has in the last 60 years POWER ENGINEERING can be expected to keep pace with progress.

If you would like to have a copy of the 36-page booklet "Sixty Years With POWER ENGINEERING" write the Editor on your company letterhead for a copy. Copies will be sent free as long as they last. Address your letter to The Editor, POWER ENGINEERING, 110 S. Dearborn St., Chicago 3, Ill.

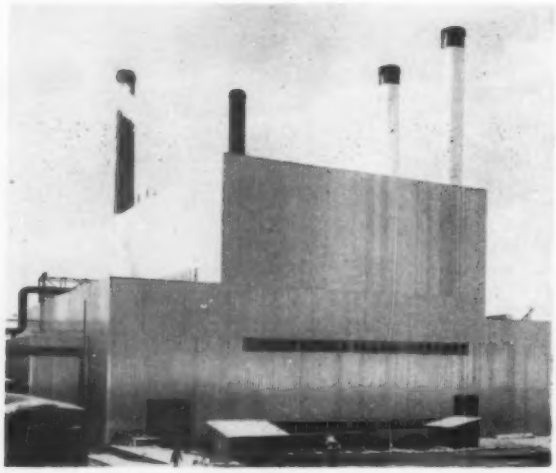


Fig. 1. Example of modern power plant building construction using low-cost panels instead of expensive brick or masonry

Fig. 2. Semi-outdoor plant in which boiler plant and auxiliaries are enclosed with the turbine generators in open

Outdoor Power Plants—An Appraisal

FOR A NUMBER of years the question of outdoor versus indoor power plants has been discussed by engineers. The technical press has probably devoted more space to the proponents, rather than to the opponents of outdoor central station power plants, which is to be expected in the advent of a new idea. Power plant executives, however, are far from being unanimous in the opinion that outdoor type plants have advantages sufficiently great to offset their inherent disadvantages.

The outdoor plant had its inception in the West. Among the earliest was one built in Southern California, and placed in operation in 1941. Since then others have been built in the West and Southwest, also several in Florida.

It is apparent at the outset that the prevailing climate of the area should receive the first consideration in planning the type of power plant to be built. The writer's experience has been confined to Southern California, where a semitropical climate certainly favors outdoor plants. But there are other factors that should be analyzed and appraised in an unbiased approach by plant designers and executives before making a decision.

Operators' Opinions

Almost 15 years of operating experience since the first plant was built have yielded considerable data as to the advantages, or otherwise, of outdoor operation. A survey of outdoor plants was undertaken and submitted to the American Society of Mechanical Engineers for panel discussion in 1954, a summary of which was reported in the June 1954 issue of POWER ENGINEERING.

Among opinions expressed by plant operating personnel there were not many serious objections. The lack of comfort in extremely hot weather or on rainy days has been mentioned. Also, in the semi arid sections of the country, where dust storms are of more or less frequent occurrence, complaints of damage from dust and grit have been reported.

On the other hand, some operators expressed a definite preference for outdoor plants. Several power plant executives ventured the opinion that employee morale is better, although the underlying reason for this may be rather difficult to explain.

From the foregoing, the conclusion can reasonably be drawn that outdoor plants within the areas of favorable climate present no serious difficulties in the matter of day-to-day operating activities. The advantages so nearly balance the disadvantages that the factor of direct operation may logically be ruled out as an item affecting decisions in the matter of type of plant.

In considering plant maintenance it is found that there is a wide divergence of opinion among operators and engineers. It is natural that such opinions should be influenced by the experience of individual plant operators. The comments grow more critical in direct ratio to the frequency of accidental outages of the vital plant units.

The writer's experience covers one accident to the main turbine, which occurred during a California rainy period. The added expenses incurred in providing shelter and protection for outdoor equipment, and the de-

Author
JOSEPH B. JOHNSON

— **About the Author** — Educated Valparaiso Univ., B.S. '08 and Purdue Univ., EX'12. Began in 1905 as draftsman with Allis Chalmers Mfg. Co. For 15 years with western mining companies on smelter and power plant construction: Chief Designer, Anaconda Cooper Mining Co., 1910–1917; Chief Mechanical Engineer, United Verde Copper Co., 1918–1925.

Chief Designing Engineer with Southwestern Engineering Co., 1925–1932.

Engineer with Metropolitan Water District of So. Calif., 1933–1939, charge of design of special equipment and plants for concrete lining of Colorado River Aqueduct.

With City of Burbank, 1939–1954, Chief Engineer of Public Service Dept., charge of design and construction of 4 units of municipal power plant and water works plants. Retired in 1954, presently engaged in consulting and engineering work.

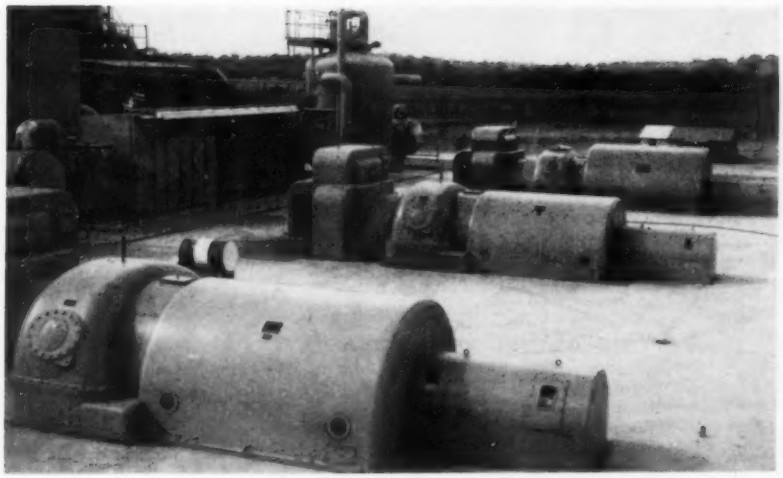


Fig. 3. Completely outdoor power plant, in which buildings have been eliminated and the boiler plant, turbine generators and auxiliaries are all out in the open

Mr. Johnson is not convinced that outdoor power plants have all the advantages their supporters claim for them. In this article he brings forward some interesting arguments to support his doubts

lays in performing repair operations through openings in rain soaked tarpaulins, added up to a considerable item; not to mention the loss of revenue due to additional outage time, which amounted to much more than the cost of mechanical repairs. In fact, the total cost was nearly twice the estimated cost had it been done in a building completely enclosing the turbine and overhead crane.

However, repairs due to accidents are not the only ones to be considered. The insidious enemy of the life of all metals is corrosion, and the outdoor plant requires more and better protective coatings for all exposed surfaces. Then there are the vagaries of the weather, such as wind, sun, rain, dust storms, humidity, condensation, daily temperature fluctuations, all of which impose conditions affecting pipe joints, valve stems, turbine casings, bearings, bolts, nuts, and pipe coverings.

Fig. 4. Outdoor type boiler added as an extension to existing industrial plant

Although furnace fires, steam temperatures, and pressure constitute the major elements of punishment of machinery and equipment, the weather adds a hazard to exposed structures and equipment that must surely be accounted for in the life of the plant. If the boilers are exposed, extra maintenance will be required to preserve tightness of settings and protection of pipe insulation. In the final balance of costs, maintenance will show up somewhat worse in the outdoor plant.

When one examines the economics of construction, the outdoor plant would be expected to reveal striking savings in cost over the conventional building enclosed plant. As a matter of fact, this promised saving was the primary objective which led to the concept of outdoor plants some 15 years ago.

At that time the typical central station plant was housed in an imposing brick and stone structure with plate glass windows, and the interior was no less elaborate, with tiled wainscotings, brass hand rails, and other appointments to match. In that era the industrial architect had more to say and do in the design of a power plant than he does today.

It may be honestly questioned if the development of the outdoor plant has led us too far from a basic tenet of true art, which postulates that a plant, as well as a home, should have an appearance consistent with its real character. The complicated array of piping, valves, ducts, burners, and accessories which are exposed in an outdoor boiler plant and rigidly located by the mechanical engineer, obviously does not lend itself to any attempt at architectural treatment. But give an architect a shell of some kind to cover the uncompromising arrangement of equipment, and he can usually transform the appearance of the plant into a pleasing exterior.

In defense against the foregoing criticism, the engineer will naturally state that all this is done to lower construction costs, which in turn lower the price of electric power to the ultimate consumer — a very laudable objective to be sure. A criticism could have been made against the industrial architect in the first place for not directing his attention to the economical design of a building enclosure that would serve its purpose for reasonable initial investment.

This has recently been accomplished in a number of plants at no detriment to appearance. In the Southern California plant previously referred to, the partial housing of the boilers was constructed at a cost no greater than the estimated extra cost of weatherproofing the piping, boiler setting, operating galleries, etc., which would have been required in a complete outdoor installation.

Turbine is Difficulty

For outdoor installations the turbine generator presents fewer operating difficulties than the boiler plant, but the real difficulty is encountered in repairing and overhauling the unit when use of the overhead crane is required.

The problem is usually approached in one of two ways: — one is to weatherproof the entire unit, with remote control of all normal operations; the other is to provide a walk-in type of enclosure for the unit, the turbine being of standard indoor design.

This latter method of design has been followed in most outdoor plants built to date, although in a number of plants the turbine only is enclosed as the weatherproofing of the generator presents no serious difficulties. Its tight enclosure necessary to maintain an atmosphere of hydrogen or air for cooling requires only simple weatherproofing. The turbine, however, with its numerous accessories, valves, etc, imposes serious difficulties.

A few years ago, at the request of a large utility, one of the manufacturers of large central station turbines, prepared designs for a complete outdoor type of turbine generator. This design was based on the installation being made outdoors without any separate enclosure; all operations and adjustments were to be performed by remote control.

The weatherproofing of the gen-

erator and exciter imposed no serious problems; the turbine, however, presented more serious though not insurmountable difficulties. The extra cost of weatherproofing for outdoor use was estimated to be about twice the cost of an individual housing enclosure for the turbine and the order was thereupon cancelled by the utility company.

The most difficult problem appeared to be the weatherproofing of the speed governing mechanism with its multitude of moving parts. These range in size and function from the small precision ground sensitive pilot valves to the powerful steam admission valves actuated by hydraulic oil under high pressure and capable of several tons thrust. The various components of the governor system should be conveniently accessible in case of trouble or adjustment, and a weatherproof enclosure almost surely involves some sacrifice of this feature. The same applies to the overspeed governor. The main throttel must be hand controlled, also the axial spindle adjustment. These accessories can be remotely controlled, but at some slight disadvantage when starting up the turbine. Indicating instruments usually attached to the turbine or close to it can also be remotely located, but a more elaborate system of instrumentation is required when control is in a remote location.

Extraction Turbines

For extraction turbines the addition of manual and automatic extraction steam valves further complicates the situation, and adds greatly to the expense of weatherproofing. The numerous small drain and drip valves attached to the steam loops and passages are usually hand controlled from the turbine deck and to make these remotely operated adds a cost incompatible with their function.

In comparing costs of a conventional indoor type of plant with that of an outdoor plant, if the outdoor plant includes complete weatherproofing of the turbine, the margin of savings in building cost will be substantially reduced.

In the case of the California plant the necessity of continuing its expansion beyond the second unit immediately posed the question of whether or not to build turbine generator No. 3, and later No. 4, as outdoor installations. After making careful investigations and estimates of cost of a complete building to house turbine units and overhead crane, the preponderance of extra cost of building and crane was too great to overcome in the interest of true economy. It was therefore decided to build units 3 and 4 as outdoor units, although the turbine housings were designed to be more commodious and were provided with better access than the first two units.

But in this case it should be understood that the gantry crane which had been installed at the time the first unit was built was of sufficient capacity to serve units 3 and 4, and a new crane would not be required in the extension of the outdoor plan. Had it not been for the extra cost of a second crane and its attendant complications, the net saving in cost in favor of the outdoor installations would have been so slight that the decision might easily have been reversed.

In general, if considerations be confined to the turbine bay only, a complete building, economically designed and constructed, and equipped with overhead crane, will add a net cost estimated to vary from $1.50 to $5.00 per KW of plant capacity, the larger plant tending toward the lower figure. This range of unit costs is based on estimates of net additional costs of indoor over outdoor installations, and therefore does not apply to the total cost of a building.

In an attempt to evaluate the total savings that can be credited to an outdoor installation, it is presumably justifiable to investigate the difference, if any, in maintenance costs between the two types of plants. In such an investigation the main item is the charge that may be levied against the outdoor plant for the longer outage time in the event of an accident, during a period of unfavorable weather, causing a major interruption of service.

Faults or accidents may originate in the electric system served by the station, or in the transmission system interconnecting two or more stations, or within the station itself. On the basis of the foregoing premise it may be postulated that one week longer is required for the outdoor station to correct a major fault or accidental damage. In the evaluation of the expected extra cost of such an outage, a 100,000 kw unit is assumed, with average daily production of 1 million kwh.

In applying the concept of probability, two main factors are involved: the probable frequency of such outages, and the probable state of the weather at the time of the outage. Even though the area selected may have a prevailing climate that is favorable, records indicate that most accidents to power systems occur during stormy or bad weather. Hence the probability of bad weather may be assumed to be equal to the good.

Outage Costs

If we assume the frequency factor as one outage every two years, with an even break between good and bad weather, we arrive at a total factor of one in four years; or five outages in bad weather during a 20 year life of the unit. The cost of the extra week's outage has been estimated at $45,000, which includes extra repair labor and loss in power revenue. This item reduced to an equivalent annual charge against the outdoor plant amounts to $11,250, which will recover in 20 years an initial capital investment of approximately $200,000.

It must be admitted that the foregoing figures are rather crude estimates and assumptions, subject to errors in judgment and opinion, although a sincere attempt has been made to be conservative.

If we may draw a conclusion from the figures cited, the expected extra costs of unscheduled outages in an outdoor plant would justify the extra initial investment in a building, even though the return on this investment may not be attractive. Several intangible factors which have been previously mentioned, however, could easily compensate for this lack. If real savings to overall plant costs are negligible, what does an outdoor plant have to commend it?

Power Station Will Utilize Waste Fuel

WORK GOES AHEAD on a number of major construction sites in Scotland and while the £20,000,000 Ravenscraig integrated steelworks of Colvilles Ltd. will not be fully in commission until early in 1957 the South of Scotland Electricity Board power station at Barony, in Ayrshire, should be in operation later in the present year.

At Barony, near the latest shaft of the great Barony Pit, a power station is taking shape intended to generate electricity from slurry, the wet, sticky, low-value residue of coal washeries. The plant will use slurry with only sufficient oil-firing and coal to get the furnaces into action. The wet substance will be taken from trucks and put into a battery of four slurry hoppers at the slidings; from there it will be ploughed on to a conveyor belt and fed into one of 16 rotary bunkers, four to a boiler. These boilers are being installed by Babcock and Wilcox Ltd., of Renfrew, Scotland.

Electricity from this station is to be supplied to the many collieries in the field, with surplus power being fed into the grid of the Electricity Board. When it opens, Barony Power Station, using what is a waste material, will be a centre of interest for people in many places other than Britain.

WOULD YOU LIKE TEAR SHEETS?

Readers wanting tear sheets of any article appearing in the issue for their personal file may obtain them by indicating the item desired on one of the post cards appearing in this issue—Editors.

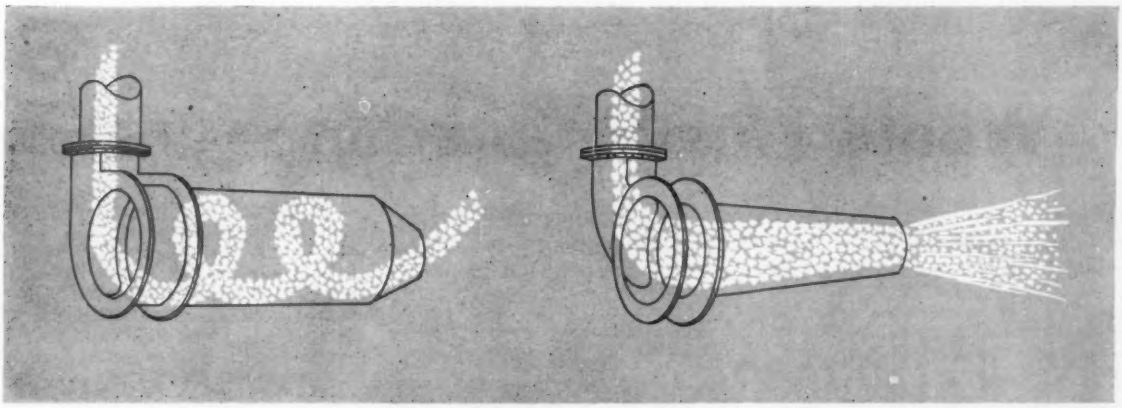


Fig. 1. Diagrams show difference in fuel flow through conventional burner at left, and new conical burner at right. With helical path, dust discharges at an angle

Report New Burner Body More Efficient

Major manufacturer set out to make pulverized coal burners more efficient. Full-scale investigation revealed some problems, answers

A RECENT development in the design of intervane pulverized coal burners has aroused considerable interest among engineers and operators of pulverized coal installations. Appearance-wise, the new design does not differ materially from the standard type of pulverized coal burner, but the manufacturer claims a considerable gain in burner efficiency as a result of changes in construction that improve the fuel flow path.

The company decided some time ago that standard burner performance could be bettered if uniform fuel distribution could be provided at the burner outlet — regardless of varying inlet conditions. This belief initiated a thorough investigation of the problem. Test apparatus was developed which permitted fuel flow to be observed without ignition of the dust-air mixture.

It was observed that almost all dust entering the standard-type burner body deposited in a thin layer on the inner surface of the inlet; the dust then made several revolutions within the inlet scroll before entering the burner body. In the burner body, the greater part of the fuel stream assumed a helical path, as diagrammed at the left in Fig. 1. When the dust load was changed, the spiral changed position but maintained its existence. As a result, concentrations of fuel left the burner tip at an angle, which adversely affects ignition stability and turn-down ratio.

To correct these conditions, the inlet was redesigned to reduce loss of kinetic energy of the stream and deposition of dust. A second change was the alteration of the burner body from a cylindrical to a conical construction, with axial baffles at right angles to the spiral dust flow. This destroys the spiral and provides more uniform distribution at the tip (*right*, Fig. 1).

Several of these new burners are in operation and give good flame shape, stability, and operating range. It is said that field experience also indicates the new burners to be less subject to coking than other designs.

For more information, write to the Editor, or jot down "Burner Body" on postcard in this issue

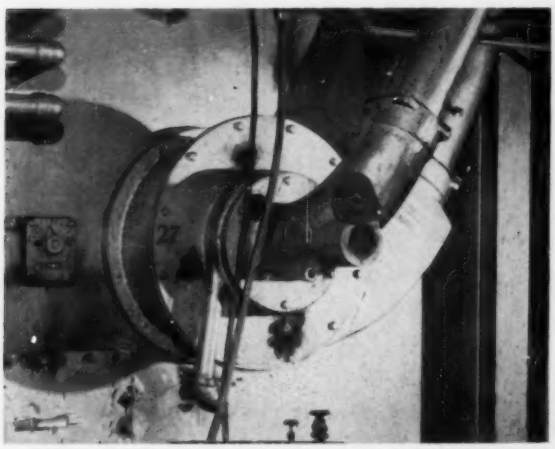


Fig. 2. A close-up view of new burner installation. Note the more gradual entrance angle of the coal dust inlet tube

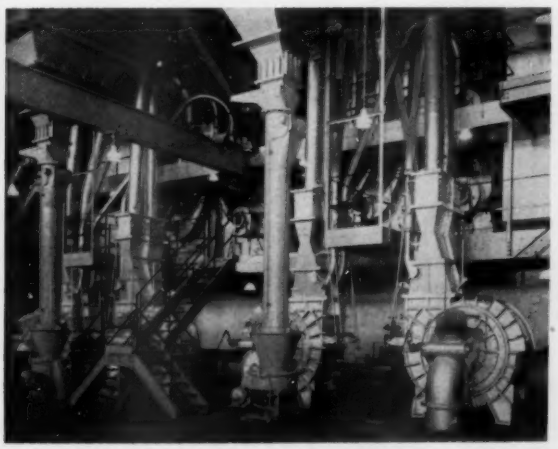


Fig. 3. Pulverized coal burner installation at a Midwest utility where new burners experience actual field operation

Would This Maintenance Control

Refinery maintenance jobs are as varied as those encountered by any power engineer, and a control system that works for a refinery should be just as effective for any power engineering maintenance

THE FOLLOWING is an account of the background, development, operation and results of the maintenance control system at The Atlantic Refining Company's Philadelphia Refinery. This system has resulted in effective maintenance control, and the cost of applying it is low enough to be economically sound.

Background

Many maintenance control systems look good on paper but are useless in practice because the cost of planning and paper work exceeds the savings obtained by the system, and because of other defects. In one of their early efforts at maintenance control, Atlantic developed time standards for wage incentive use. These standards were applied by rate setters after the work was performed. This system proved to have several defects:

1. Because methods were not standardized, the standards covered small elements of work that could be put together in any combination. Development of the job standard was, therefore, expensive in clerical labor.

2. Even with small work elements, complete coverage could not be obtained.

3. Men did not know what the standard was until after the job was finished.

Another time Atlantic tried planning a complete rebuilding job in advance — to eliminate the defects of unpredictable methods and to give the workmen a target to shoot at. When completed, the job standard was 46 man-days. It took the rate setter 10 days to work out the details of the method, get agreement on these details, and compute the standard. This 22 per cent overhead was too much. Although this one sample may not be precisely representative, it is good enough to show that the system cost too much.

The problem then was to predetermine the method and preset the time allowance and still get a return for the company. They couldn't go through all the detail required by small-standard wage incentive standards, and yet they couldn't see how they could use bigger standards without standardizing the method. And so they were forced to the conclusion, even though it was a direct affront to the philosophy that maintenance work is unstandardizable, that maintenance methods *had* to be standardized. Once methods were standardized, big time standards would become possible, which would mean that the cost of planning could be kept low enough to make the system economical.

Development

Many people still think of maintenance as unpredictable, yet all maintenance work is repetitive and can be standardized and predicted quite accurately. Any ½ in. "V" grove horizontal butt joint weld is like all others; when you've done one you can do them all and the same thing applies to just about every maintenance operation. With this in mind, Atlantic first prepared Standard Practice Instructions (SPI's) for all their normal maintenance jobs. These instructions cover method, sequence, materials, tools and other essential information for each job. Examples of SPI's are shown in Figs. 1 and 2.

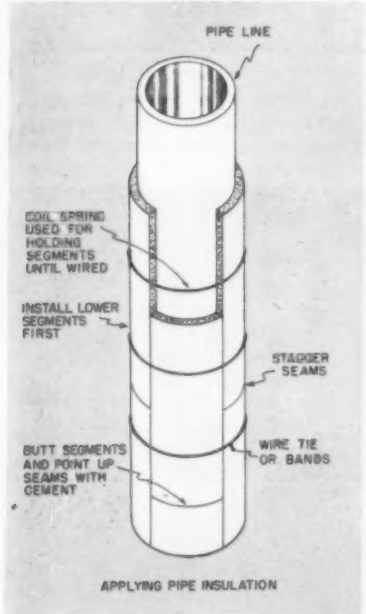

PIPE LINE
COIL SPRING USED FOR HOLDING SEGMENTS UNTIL WIRED
INSTALL LOWER SEGMENTS FIRST
STAGGER SEAMS
BUTT SEGMENTS AND POINT UP SEAMS WITH CEMENT
WIRE TIE OR BANDS
APPLYING PIPE INSULATION

Fig. 1. Standard Practice Instruction (SPI) shows method of doing such a job

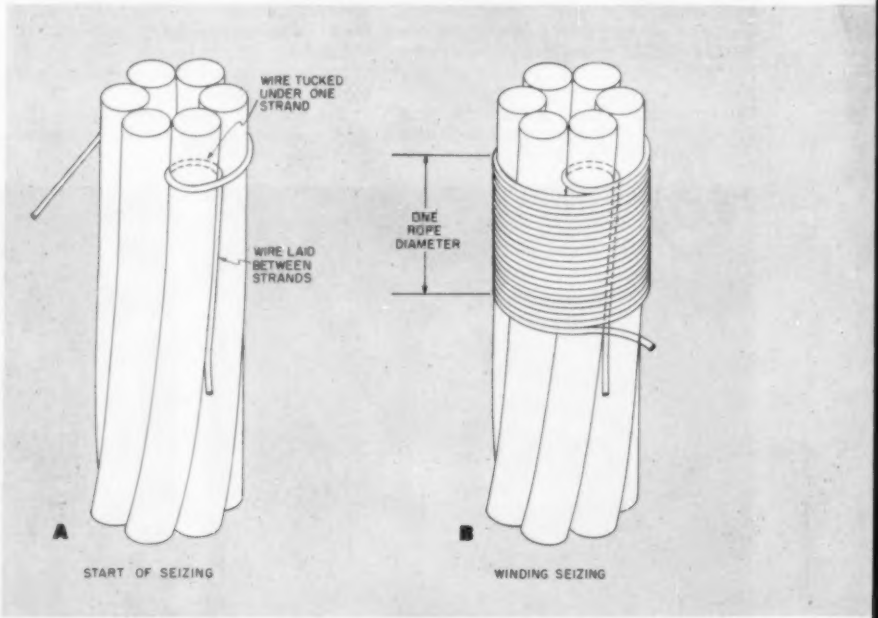


Fig. 2 (a, b, and c). Shows example of work sequence given in SPI's. Here the correct method of seizing a wire rope is illustrated by simple sequence of drawings

System Work For You?

Next, Engineered Planning Times (EPT's) were established for the standardized craft work methods developed for specific jobs.

Finally, all maintenance people were trained in the methods and procedures specified in the SPI's.

Operation

Once the SPI's and EPT's were prepared and everyone knew how to use them the scheme could be put into operation. Here's how the system works:

1. All work orders go first to the Zone Engineers' offices. As soon as a work order is received, the Zone Engineer concerned contacts the originator of the work order, inspects the job site with him and discusses the proposed work until he thoroughly understands the intention of the work order.

2. The job is then planned. Plan shows extent of the job, crafts and equipment required, priority, materials needed and times for each craft. Copies of the complete job plan are then forwarded to the Zone Foreman and Work Control Group.

3. Work Control Group compiles priorities and work loads for all jobs in all zones. Then a preliminary work schedule is prepared for all jobs in all zones. This preliminary schedule is presented to top field and shop supervision and general agreement obtained or the necessary changes made.

4. Field and shop supervision then forward final approved schedules to Zone Foremen, who are then in a position to allocate work to Job Foremen.

5. Time actually taken to perform the work is recorded by the Foremen and routed back to the Work Control Group, where actual versus planned time ratios are set up. This group reports periodically to management. Top management can then utilize the information in controlling activities in field and shop sections. Figure 3 shows the work control procedure in chart form.

Results

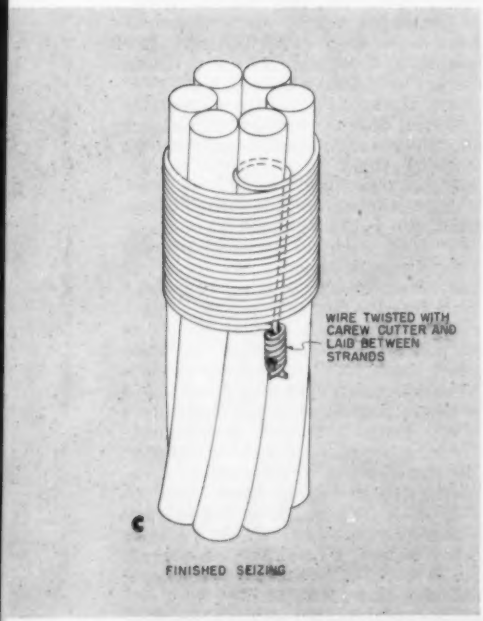
Results of this operation have been good. Planned/Actual manpower has averaged 95 per cent. Also considerable time has been saved in construction and maintenance.

Another highlight is that with definite work methods, work sequence, tools, materials and other essential information, it is possible to develop large labor measurement values. Where previously each detail of a job had to be laboriously worked out and then what seemed like endless computations had to be made, it is now possible, for example, to give one figure for the total labor, materials, and supplies required for complete roof replacement of a 100 foot tank. These large consolidations are extremely useful for long-range forecasting. With them top management has a very good idea of what their manpower requirements will be by craft a year or so in advance.

Coöperation

Another benefit of the system shows itself at the job level. By having the planning and procedures settled at the engineering level, the Foreman can devote his energy to getting the job done, and done right, without having his mind occupied with problems that can be *pre-solved.*

To put this standard methods system into practice a great deal of cooperation was required of all departments. Those of Atlantic's people who were involved: Industrial Engineers, Mechanical Department technical personnel and working Foremen, worked closely together first to develop the system, and then worked closely with process operators, inspectors, safety personnel, etc., to put it into operation. In this venture this coöperation was the key to success.



Standard Practice Instructions also list tools and materials for each job

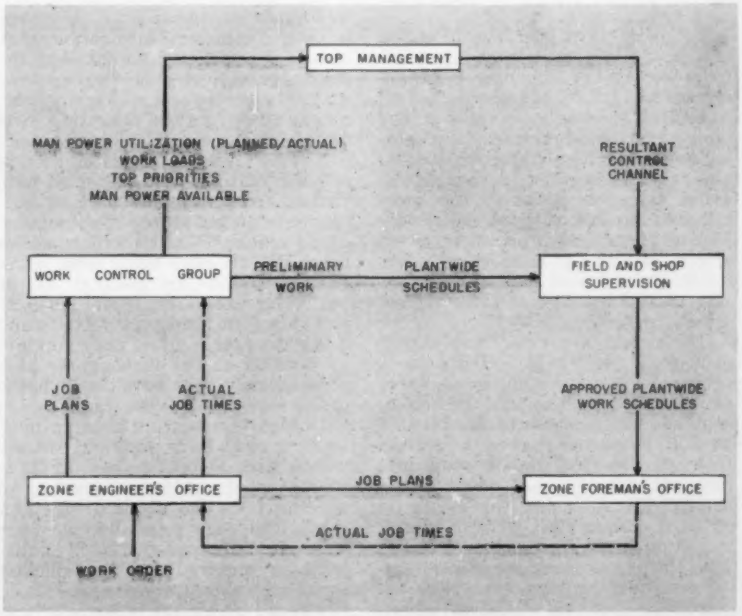


Fig. 3. Organization chart for maintenance control system described in this article. Among other duties, work control group compares estimate with actual costs

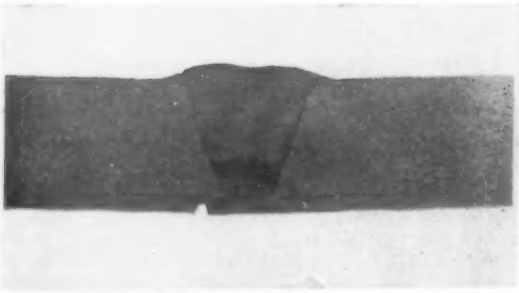


Fig. 1. Shows a crack in the root of a pipe weld in a joint with the integral overlap-type of root preparation

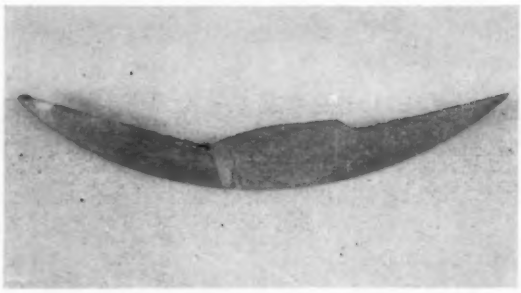


Fig. 2. Crack in carbon-steel repair weld caused by carbon migration resulting from use of wrong type of electrode

How Sound Are Inert-Gas Tungsten-Arc

This welding process, says the author, despite certain problems, will be used more and more for high-temperature piping. He explains what the problems are and indicates some ways they can be solved

By HELMUT THIELSCH*

FAILURES in high-temperature steam piping systems are not only very costly, but they may also seriously endanger the life of operating personnel. A number of near-failures, discovered as part of routine examinations of main steam piping systems, have shown that various causes may lead to service failures.

Rather disastrous and costly failures might have resulted if these near failures had not been discovered in time. In an emergency, shutdown of a steam power plant operating unit may cost from $6,000 to $15,000 for each day.

To insure the proper level of safety of a piping system, extreme care has to be exercised in: (1) design of piping system and joints; (2) selection of all base and welding materials in the piping system; (3) fabrication, welding and inspection of all components; and (4) subsequent operation to avoid excessive peaks in the operating conditions, such as excessively high temperatures or pressures, or excessive thermal or mechanical shock loads. Examples of various near failures caused by each of these factors are shown in Figs. 1 to 4.

The carbon-steel repair weld shown in Fig. 2 was made initially on a carbon-½ molybdenum steel valve prior to field welding with carbon-½ molybdenum steel electrodes. Service at 900 F caused carbon migration from carbon-steel repair weld into adjacent carbon-½ molybdenum steel areas with sufficient weakening in affected carbon steel weld to permit initiation and propagation of crack. Had the proper electrode of a carbon-½ molybdenum steel type been selected the cracking would have been avoided.

Constant search for new, better and more efficient pipe fabricating techniques must be based upon very thorough laboratory research investigations, in which each new technique is evaluated under all possible variations of favorable as well as unfavorable shop and field fabricating conditions. Frequently a new fabricating process or welding technique is developed and, because of excessive enthusiasm or lack of interpretive know-how, is adapted in the commercial fabrication or erection of piping.

It may well be that the new technique results in fabricated assemblies of very much superior appearance. However, the respective investigators, in their zest to rush the project to completion and use the technique in their commercial fabrication, may have neglected to consider that the resulting fabricated section or weld may contain defects which may significantly reduce the operating level of safety of a critical piping system.

The fact that a fabricated section or weld joint has been inspected with various conventional inspection techniques is no guarantee of soundness. Small cracks, inherent brittleness or other defects may have been introduced. If they are peculiar to the particular fabricating technique used, and are not common with other fabricating techniques, they may not be familiar to the investigator and, consequently, may have been ignored in the experimental program.

In high-temperature steam piping, backing rings have been and are still widely used in butt-welded joints in piping inaccessible for grinding or welding from the inside of the pipe joint. They are generally necessary where a "full penetration" quality joint is required by the shielded metal-arc welding process with "stick" electrodes or by the automatic submerged-arc welding process.

The backing ring provides "back-up" against which the root pass is deposited. This helps to (1) avoid burn-through and formation of icicles, (2) prevent weld spatter and slag drippings from falling into the pipe and (3) insure full penetration and fusion at the root of the butt weld in all positions of pipe welding.

Actually, there have been extremely few failures among the many hundred thousand critical main steam pipe joints made with backing rings. Consequently, shielded metal-arc welding against backing rings should be considered as a completely satisfactory method of pipe welding. The extremely few isolated instances where failure across the weld joint has occurred, or where the backing ring has been loosened during service, can be related almost always to improper welding, particularly where the root penetration was incomplete or the fit-up was very poor.

If such improperly-made welds had been observed in the initial radiographs and repairs had been made, failure would have been avoided. Far more piping failures are caused by material defects, wrong materials, or improper design conditions, than by backing rings not properly welded into the pipe joint.

Nevertheless, there are obvious advantages to the elimination of backing rings, such as uniform internal pipe diameter at welds, avoidance of crevices between backing rings and pipe for possible entrapment of corrosive substances, and so on. It is assumed, of course, that the weld joint made without backing rings is equal in quality and soundness to the backing-ring type joints heretofore used. Early attempts to eliminate backing rings consisted of integral overlap-type root preparations, as illustrated in Fig. 5. Since improperly-fused root passes tended to leave dangerous notches, these methods have generally been discarded again in favor of the more conventional backing-ring methods.

In recent years the inert-gas tung-

* Metallurgical Engineer, Grinnell Co., Inc.

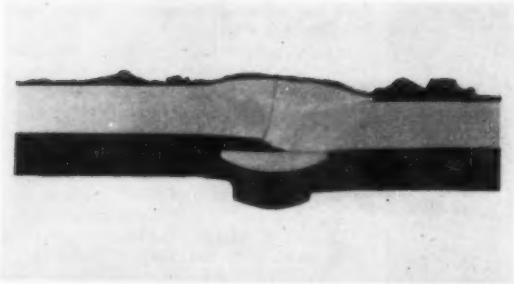


Fig. 3. Stress-corrosion crack in 1-p steam piping originating at notches caused by improper fit of pipe ends

Fig. 4. Shows split in boiler tubing of carbon-½ molybdenum steel caused by overheating on fire-side of tube

Root-Pass Pipe Welds?

sten-arc process has been applied to welding the root pass in pipe joints to eliminate the need for backing rings. Unlike the integral overlap-type joints which could contain undesirable notches in the completed weld, joints made with the inert-gas tungsten-arc root-pass welding process were believed to be sound and free of undesirable notches.

In this process as applied to piping, an arc is struck between the land at the bottom of the pipe groove and a single thoriated tungsten electrode. During welding, argon or helium gas flows around the electrode and over the weld metal pool to prevent contamination by the atmosphere.

The underside of the weld along the ID of the pipe is also frequently protected by an inert-gas blanket. This is usually referred to as purging, which may be done at a slight positive pressure. For gas conservation purposes, special purging fixtures are usually employed, which limit the purging gas to the immediate weld area.

The standard 37½ deg V bevel preparation widely used on pipe of wall thickness up to ¾ in. thick is less suitable for inert-gas root-pass welding. Joint preparations similar to those illustrated in Fig. 6 are generally preferred. The U and the special V bevel preparations with the "flat-land" are more costly to machine than the straight V bevel.

However, the U and "flat-land" bevels allow better tungsten electrode manipulation and more rapid electrode travel. Moreover, they reduce susceptibility to cracking in the root deposit and provide more uniform root penetration.

Unfortunately, detailed laboratory investigations and extensive commercial fabrication experience have shown that some of the early highly-favorable reactions to the inert-gas tungsten-arc root-pass welding process have been somewhat premature. Sections removed from commercially-made pipe welds have revealed the presence of fine root cracks.

After several years of service some of these fine cracks have been extended deeper into the pipe weld. Since these root cracks were not detected by conventional radiographic inspection techniques, the welds were not repaired prior to placing the piping system into service.

Obviously, their presence represents potential danger points to the piping system. Under service conditions of mechanical or thermal fatigue or shock, stress corrosion, or creep, these small cracks may be extended and propagated and ultimately lead to a failure across the joint.

Whereas a sudden severe shock

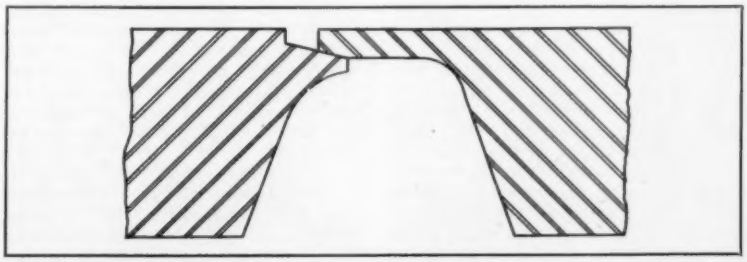


Fig. 5. Example of special pipe joint design to eliminate use of backing rings

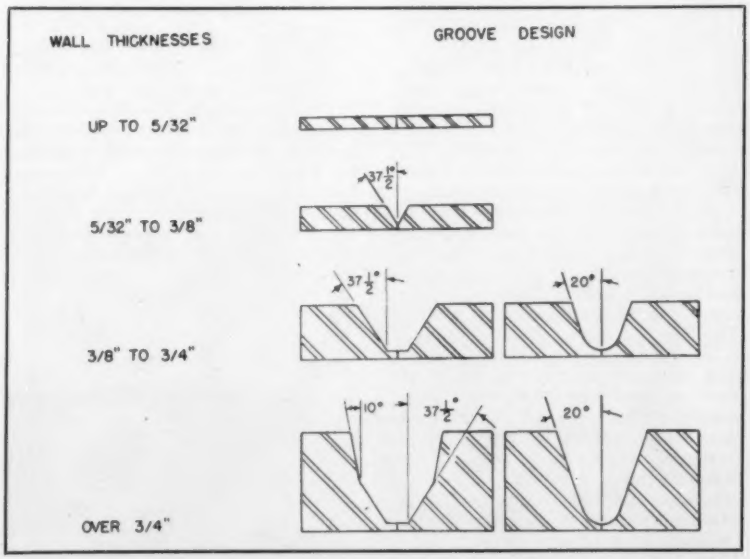


Fig. 6. Joint designs commonly used for the inert-gas tungsten-arc root pass welding of piping materials. With this type of joint backing ring can be eliminated

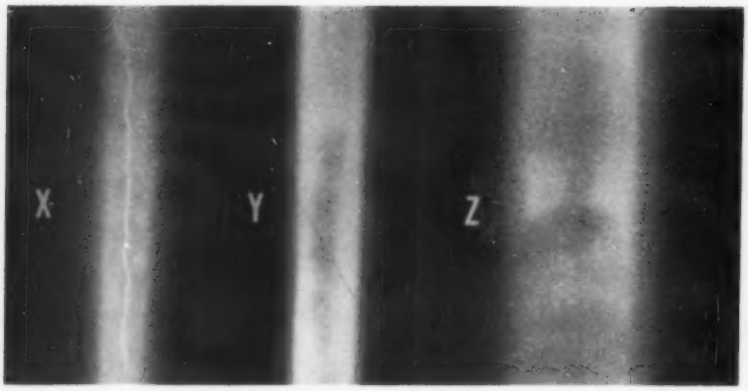


Fig. 7. X-ray photos showing apparent disappearance of crack after second weld pass. X shows root pass (weld 1/16 in. thick). Y shows joint after first cover pass (weld 1/8 in. thick), and Z shows same joint after second cover pass (3/8 in. thick)

may result in an almost instantaneous disastrous "explosive" rupture, thermal fatigue, such as may result from periodic power plant shutdowns, may propagate the root crack very gradually and cause rupture across the joint in a period of 5, 10 or 15 years. Fortunately, in the very large majority of cases, rupture is extremely gradual.

Best insurance against the presence of the fine root cracks is to use completely developed procedures performed by thoroughly qualified, trained and experienced welders, continuously supervised. An additional requirement is the establishment of rigid inspection techniques. This naturally favors shop welding over field welding. Consequently, prefabricated assemblies made under shop conditions should be employed wherever possible.

The difficulty in determining root-pass cracks by radiography is illustrated in Fig. 7. The root in the 6-in. 1¼ Cr — ½ Mo Schedule 80 (0.432 in. wall) pass, which was made inert-gas tungsten-arc root-pass welding, contained the 2½-in. long crack shown in Fig. 7X. As is standard practice, the subsequent passes were made by shielded metal-arc welding with ¼ Cr — ½ Mo (AWS-ASTM E8016-B2) covered "stick" electrodes.

After the first cover pass with the covered electrode, the root-pass crack was no longer visible by X-ray radiography (Fig. 7Y). Subsequent sectioning showed that root pass crack was nevertheless still present, Fig. 8.

The "disappearance" of the crack was caused by the shrinkage of the first covered electrode pass which drew together tightly the crack in the root pass. Certainly the potential danger of such cracks has not been lessened by their being closed up mechanically. Radiographic techniques employing gamma rays or radioactive isotopes are less sensitive than X-rays and would be even more unlikely to reveal the presence of root cracks.

Presence of these root pass cracks cannot always be observed by careful visual examination of the initial inert-gas tungsten-arc pass. Even the best welders, therefore, may not be aware of their presence. Detection of these cracks in chromium-molybdenum alloy steels is further complicated by the continuous preheat requirements of most specifications, which state that the preheat temperature (usually between 400 and 600 F) must be maintained without interruption, until the whole weld has been completed or until at least several layers of weld metal have been deposited.

For example, *Pipe Fabrication Institute* Standard ES (M) 8-1955 states that "Welding on 1 CR — ½ Mo and 1¼ Cr — ½ Mo materials may be interrupted at any time, provided that a minimum of at least ⅜ in. thickness of weld deposit or 25 per cent of the welding groove is filled (whichever is greater)". On 2¼ Cr — 1 Mo, 3 Cr — 1 Mo and 5 Cr — ½ Mo welding may not be interrupted unless a partial or complete stress-relieving heat treatment is given.

The *American Welding Society Committee on Piping and Tubing* states in its Recommended Practices for Interruption of Heat Treatment Cycles for Low Chromium-Molybdenum Steel Piping Materials that, on all of these steels, preheat should in no case be interrupted before ⅓ of the wall thickness or two layers of weld metal (whichever is greater) are deposited.

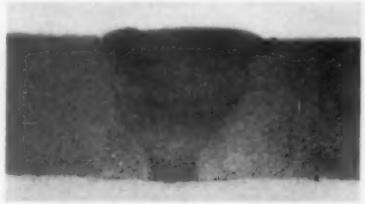


Fig. 8. Etched photo of weld of Fig. 7 showing root pass crack still present

The continuous preheat requirement on the chromium-molybdenum steels of 400 to 600 F, eliminates the dye-penetrant inspection methods for inspection of the root pass. Thus the only remaining techniques showing promise at this time on chromium-molybdenum alloy steel piping are magnetic particle inspection and special radiographic procedures employing radium or radioactive isotopes.

Both of these are now being investigated. Conventional magnetic particle techniques have failed to detect some of the fine root-pass cracks which do not extend to the surface of the root-pass weld.

Safest practice is to: (1) use highly experienced and thoroughly responsible welders; (2) specify welding procedures that minimize the tendency for root-pass cracking; and (3) have the inert-gas root-pass searchingly inspected by a qualified inspector or responsible welding supervisor. Thus on piping of diameters exceeding 6 in., radiographs made after welding ¼ in. of the pipe wall thickness may provide some additional insurance by detecting the larger of the root-pass cracks.

It seems also advisable that critical steam piping systems containing welds made by the inert-gas tungsten-arc root-pass welding process be occasionally checked for continuous quality and soundness after service periods of 5 to 10 years.

With further progress in inert-gas welding procedures and inspection techniques, highly satisfactory and serviceable weld joints are likely to be made by the inert-gas tungsten-arc process as part of normal fabrication practice. However, only after a 10- to 20-year high-temperature service record is available, should power plant engineers relax their watchfulness of joints made by this process. (Such a record of over 20 years of satisfactory service is available on pipe joints made with backing rings.) On the other hand, progress must not stand still, but must be encouraged in order to develop better, safer and more economical fabrication.

Service environments are constantly increasing in severity. Pipe joints in service at 800 F may have been completely satisfactory when made with a particular welding process and procedure and joint design. However, for steam power service of 1100 F or 1200 F or even higher, joints made under the same conditions, though in different materials, may fail. As result, the soundness and level of safety of fabricated piping must be verified and checked with thoroughness.

Notwithstanding the present problems, the inert-gas tungsten-arc root-pass welding process, because of its desirable design and appearance features, is likely to be specified in an ever-increasing degree, on chromium-molybdenum, stainless steel and other alloy piping.

School for Nuclear Power Engineers

Argonne National Laboratory's School of Nuclear Science and Engineering is international. It offers courses to qualified students from all over the world

ONE OF the provisions of the Atomic Energy Act of 1954 authorizes the U. S. Atomic Energy Commission to provide technical assistance to foreign nations in the peaceful use of atomic energy. Among the more important consequences of this provision was the establishment, last year, at Argonne National Laboratory, of the School of Nuclear Science and Engineering.

This school opened in March 1955 — just a year ago — and now is giving its second course. The present class consists of 61 students: 21 of which are United States students and 40 are from foreign countries. Among the Americans 18 are sponsored by industry, 3 are from the AEC and one is from the REA.

All students are required to have a good working knowledge of the English language and the equivalent of a bachelor's degree in one of the physical sciences or engineering. An understanding of applied mathematics through differential equations is assumed.

In the present group there are 22 with Ph.D. degrees. The present course consists of five months of classroom and laboratory work and four months of assigned work in groups on design of reactors followed by two months devoted to visits to other nuclear laboratories.

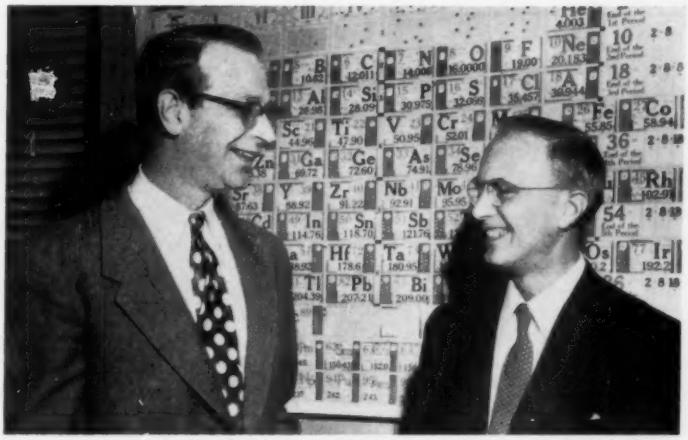


Fig. 1. A. W. Kramer, Editor of POWER ENGINEERING, and *Atomics* (right), with Dr. Rollin G. Taecker, Deputy Director, School of Nuclear Science

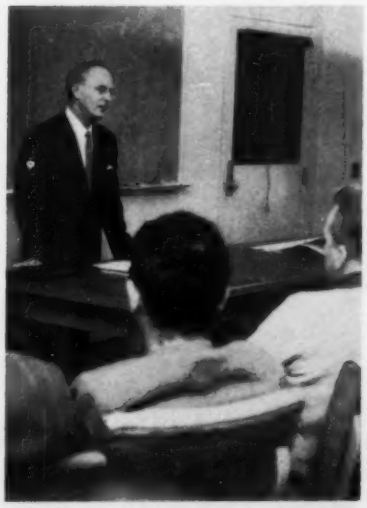
Under *Reactor Engineering* the students deal with problems involving different types of reactors — heat removal including fluid flow, heat transfer, stresses, and vibration; principles of fuel element design; coolants, corrosion; reactor structures, control elements and systems, control rod drives; reactor shielding design, auxiliary equipment such as pumps and heat exchangers; loading and unloading of used fuel; reactor buildings including ventilation of reactor; heavy water production; and economic studies.

Production of radioactive isotopes is also discussed briefly. The emphasis in the course is placed on the integration of all the phases of the work related to reactor design rather than on the detailed design of any particular type.

Laboratory courses include six hours per week of experimental reactor physics, four hours per week of reactor engineering laboratory where experience will be given in the operations of the CP-5 reactor. There are three hours per week of analytical procedures involving the quantitative determination of uranium, plutonium, thorium, and some of the major fission products.

Six hours per week are devoted to separation processes. This includes laboratory work on distillation, solvent extraction, and ion exchange. Laboratory work on the physical metallurgy of reactor materials including melting, casting and fabrication of experimental samples is also given.

The teaching in the school is conducted by a special full-time staff under the direction of Dr. Norman Hilberry. Dr. Rollin G. Taecker is Deputy Director of the School. This special staff is aided by the members of Argonne's Laboratory research and development staff who teach many of the courses and assist in the experimental design work. The staffs of other atomic energy installations and other outstanding scientists and engineers are also asked to give special lectures from time to time.



Figs. 2 and 3. Editor Kramer, left, addressing the School of Nuclear Science and Engineering when he was guest lecturer at a recent session of the School

Balancing a Turbine Generator

Fig. 1. Vibrometer in use. The instrument rests on the turbine casing, and light on the glass screen (arrow) shows vibration on that point. Stroboscope (Fig. 4) gives angular position of shaft for each vibrometer reading

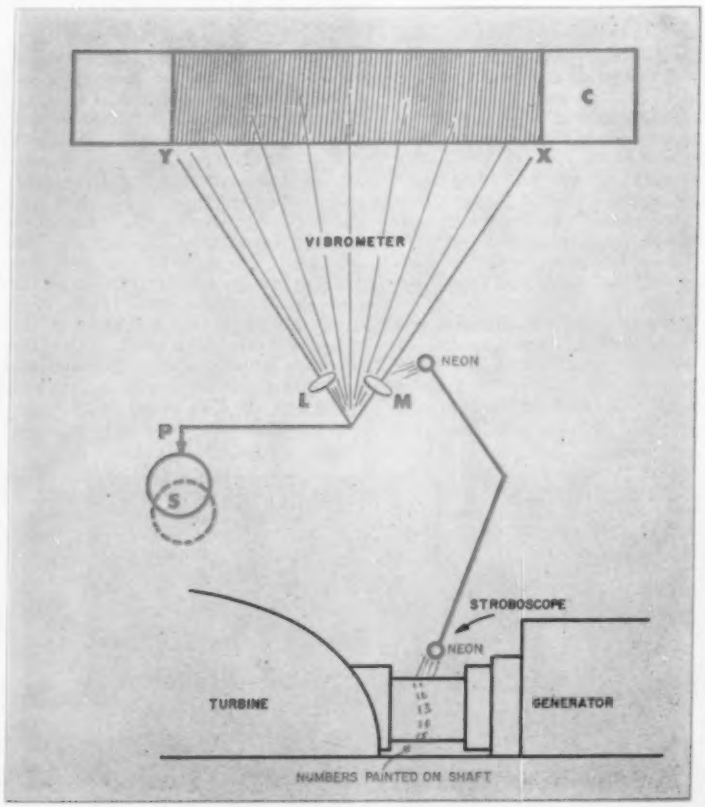


Fig. 2. Diagram of balancing arrangement. At point of maximum displacement, vibrometer neon reflects from mirror M to screen at X. At the same instant, stroboscope illuminates the shaft and shows its angular position

This is the thirteenth article in a series describing the scheduled overhaul of a 25,000 kw turbine generator at U. S. Steel Corp.'s South Works in Chicago. When all the articles have been published the whole series will be reprinted. To reserve copies of the reprint write to the Editor

WHEN the unit was put back into service it was found to have a slight unbalance. Readings were taken over a period of one or two weeks at different loads, and the vibration was found to be enough to justify rebalancing.

To find out where to add or remove balance weights from the spindle, two instruments are used: A vibrometer and a stroboscope.

The vibrometer is shown being used in Fig. 1, and the diagram in Fig. 2 illustrates the principle of the instrument. Pointer P rests on shaft S, which is out of balance. P is joined by a crank mechanism to a mirror M which reflects light from an incandescent lamp and throws this reflected light onto a ground glass scale C. As the shaft rotates, pointer P follows the up and down movements of the unbalanced shaft, and mirror M tilts from side to side (M to L) causing the light to show on the screen as a wide band of light.

Fig. 3. Numbers painted on shaft so angular positions of shaft can be seen at moment of maximum displacement

When all these turbine overhaul articles have been published we plan to reprint the whole series. If you want to reserve one or more copies write to the Editor

The more motion in the shaft, the more the movement of the mirror, and the wider the light band on the scale. Thus the width of the light band is a measure of the vibration amplitude, and the screen is calibrated so that the vibration can be read directly in thousandths of an inch.

Knowing the amount of vibration is not enough; we need to know *where* the spindle is out of balance.

Built into the casing of the vibrometer is a neon lamp. This lamp lights once for every revolution of the spindle, and it lights for only a fraction of a revolution. The light from the neon is reflected off mirror M and appears on the screen as a red line of light.

If the neon lamp lights up at the instant the maximum heavy side of the shaft comes under pointer P, then the red line will show at X on the screen. On the other hand, if the neon lamp lights up when the light side is under the pointer, then the red line will show at Y. In practice, because the frequency of the neon lamp supply is fixed, but the speed of the spindle might vary slightly, the red line will appear to move slowly over the screen.

Whenever it reaches X, the man using the instrument knows that during the time it remains at X the neon lamp is lighting every revolution just at the moment when the heavy side comes under the pointer.

Connected to the same supply as the neon lamp in the vibrometer, and flashing on and off at the same time as the lamp in the vibrometer, i.e. once every revolution, is another neon lamp which is housed in the stroboscopic tachometer shown being used in Fig. 4. On the turbine spindle, at a point where the shaft is visible, a series of numbers, from 1 to 15, are painted. They can be seen in Fig. 3 and Fig. 5.

The stroboscope light is shined on these numbers while the spindle is rotating (Fig 5). Suppose the stroboscope neon lights up momentarily just when number 10 on the shaft comes opposite the observer, and for the rest of the revolution the shaft is in darkness. The only time the observer will see the shaft will be when the neon light comes on, and every time this happens he will see the number 10 in front of him.

The shaft will seem to be standing still, but what it really means is that at the moment the stroboscope neon comes on, the angular position of the turbine spindle is such that the painted number 10 is facing the observer. If at the time the stroboscope neon shows that number 10 is facing the observer, the vibrometer neon shows that the point of maximum unbalance is under the pointer, we would know that the point of maximum vibration comes under the pointer when the turbine spindle is in such a position that the painted number 10 comes opposite the observer.

In practice, when the red neon mark on the vibrometer pauses at the point of maximum vibration, the man using the stroboscope notes which number on the shaft is facing him. In this case a whistle was used to signal so that both observations (i.e. the point of maximum vibration as shown on the vibrometer and the number on the shaft as shown by the stroboscope) could be taken simultaneously.

Thus the shaft position for maximum vibration at any point on the machine could be determined by means of these two instruments.

Vibrometer readings were taken at various points along the unit, and for each position the angular position of the shaft was noted. These readings were then analyzed to establish where balance weights were needed or from which part of the spindle they should be removed.

Having determined where weights were needed, the unit was shut down and a plughole in the high pressure cylinder was removed. The correct position of the spindle was brought opposite this plughole by rotating the spindle by means of the turning gear.

In Fig. 6 a balance weight is shown being passed through the plughole in the turbine casing to be installed in its correct position in the turbine spindle.

When all the required weights had been added or removed, the machine was put back on load and the process repeated until the vibration readings were satisfactory at all points.

Fig. 4. Stroboscope in use. It flashes on shaft numbers (Fig. 3) and shows angular position of shaft at any instant

Fig. 5. Numbers in stroboscope light. When vibrometer operator signals, strobe operator notes shaft position

Fig. 6. Arrow shows balance weight being added to spindle through hole in casing. Weight is held in threaded tube

Fuel Heat Values and Air Requirements . . . . . *A Graphical Solution*

By GLEN H. HOWELL*

WHEN AN ENGINEER is faced with several solutions of a single equation he usually does something to make the solution easier. He may set up a series of constants to "plug in," or he may set up a graph. In either event, he is attempting to reduce the routine phase of his work so he can use his time more usefully on the non-repetitive type of work.

Included with this article are two graphs that may be helpful to the combustion engineer. One graph is the solution of the familiar Dulong's Equation for determining the higher heating value of a fuel; the other is to determine the weight of air for theoretically perfect combustion. In both cases it is assumed that the per cent composition by weight is either known or easily calculated.

Review of Heating Value Data

A brief review of the bases from which these equations were developed may be helpful at this point. Dulong's Equation is:

$$HHV = 14{,}540\ C + 62{,}000\ [H - (O_2/8)] + 4050\ S \quad (1)$$

where:

HHV = higher-heating-value of the fuel, btu/lb
C = carbon in the fuel, lb per lb of fuel
H = hydrogen " " " " " " "
O_2 = oxygen " " " " " " "
S = sulfur " " " " " " "

The constants in the equation represent the heat that would be liberated if one pound of carbon, hydrogen, and sulfur were respectively burned to their final products. This assumes the combustion is to CO_2, H_2O, and SO_2.

Since hydrogen and oxygen have a high affinity for each other, the portion $[H - (O_2/8)]$ contemplates that the hydrogen will have combined with all the oxygen available to form water vapor in the ratio of 8 pounds of oxygen to each pound of hydrogen. Thus, if there is not sufficient oxygen to complete the reaction with all the hydrogen, that which remains is "free" hydrogen and will give off 62,000 btu per pound when combustion takes place. The factor $(O_2/8)$ represents the combined portion and $[H - (O_2/8)]$ represents the "free" portion. Of particular interest here is that the factor $[H - (O_2/8)]$ will be the same whether the moisture is reported separately in the ultimate analysis or whether it is reported as its separate constituents, hydrogen and oxygen.

Obviously if other combustible elements than carbon, hydrogen, and sulfur are present, neither equation (1) nor the graph, Fig. 1, will be usable. However, the graph, when used with care, will give results that are as accurate as the equation. In either case, certain types of coals containing calcium carbonates will be somewhat in error but not excessively so. For example, Coal "A" as shown on Figure 1 has a higher-heating-value of approximately 14,250 btu/lb. By calorimeter, this same coal shows a higher-heating-value of 14,099 btu/lb, or, the error is about 1 per cent. Coal "B" has a higher-heating-value from the graph of 9750 btu/lb, while a calorimeter determination shows the actual value to be 9940 btu/lb. The error is still less than 2 per cent, and these values are relatively typical.

Analysis of Heating Value Graph

Although Dulong's Equation uses the weights of the constituents per pound of fuel, Fig. 1 plots these values directly in percentage. Even the hydrogen and oxygen are used directly from the reported ultimate analysis in percentage. Actually the figures on the $[H - (O_2/8)]$ curves represent the per cent of "free" hydrogen by weight in the coal.

To illustrate the use of the curves, two typical coals with wide difference in analyses are shown. The ultimate analysis of each is given in Table I.

Values for $[H - (O_2/8)]$ for each coal was determined in percentage. Entering the curves at per cent by weight of carbon, a horizontal line was carried rightward to its intersection with the correct value of $[H - (O_2/8)]$. From thence, a vertical line (upward or downward) was projected to the zero sulfur line. Here a horizontal line was carried to the per cent of sulfur in the coal, and from this point, dropped vertically to the heating value determinant.

If no sulfur was present, the vertical line, from the intersection of the carbon content line with the $[H - (O_2/8)]$ value would be projected downward to determine the heating value. A lack of any oxygen would indicate that the observed value for hydrogen should be used, and the absence of hydrogen and oxygen would indicate that the zero-curve intersection with the carbon content line, should be the point from which the first vertical would be projected. Within the range of carbon content shown, this graph is usable for all types of fuel containing the elements shown — where the percentages by weight can be computed.

Table I. Ultimate analyses of two coals for deriving curves plotted in Fig. 1*

	Coal "A"	Coal "B"
Carbon	53.89	85.38
Hydrogen	3.77	2.98
Sulfur	4.05	0.80
Oxygen	7.63	1.19
Nitrogen	0.91	1.12
Moisture	16.00	2.70
Ash	13.77	5.83
Heating value by calorimeter (btu/lb)	9940	14,099

* Table from Steam, Air, & Gas Power (5th Edition), by Severns, Degler, and Miles; John Wiley & Sons, Inc., New York

Review of Theoretical Air Data

The general equations for complete combustion of a fuel are shown below:

$$C + O_2 + 3.76N_2 \rightarrow CO_2 + 3.76N_2 \quad (2)$$
$$2H_2 + O_2 + 3.76N_2 \rightarrow 2H_2O + 3.76N_2 \quad (3)$$
$$S + O_2 + 3.76N_2 \rightarrow SO_2 + 3.76N_2 \quad (4)$$

In the above equation, the term $3.76N_2$ represents the number of moles of nitrogen that is associated with each mole of oxygen in the air. This figure is based on air being 79 per cent by volume nitrogen and 21 per cent by volume oxygen.

By using the molecular weights of these constituents it can be shown that each pound of carbon requires 11.5 lb of air for complete combustion. Correspondingly, "free" hydrogen requires 34.5 lb of air per pound and sulfur requires 4.32 lb of air per pound. These values can be combined into an equation taking the same general form as Dulong's Equation, and is:

$$A_T = 11.5\ C + 34.5\ [H - (O_2/8)] + 4.32\ S \quad (5)$$

where:

A_T = weight of theoretical air, pounds per pound of fuel
C, H, O_2, and S are the weights of the respective elements in pounds per pound of fuel, and the constants represent the number of pounds of air per pound of the element with which it is associated.

Analysis of Air Graph

The general layout of Fig. 2 is very similar to Fig. 1 except that the horizontal coordinate is "Theoretical Air — Pounds per Pound of Fuel." Therefore, the procedure for using Fig. 2 is the same as for Fig. 1.

The area of usefulness, as well as the degree of accuracy, can be considered as being comparable for Figs. 1 and 2. In both cases, the accuracy and area of use could be extended by plotting to a larger scale; but it is questionable whether this could be justified. By skillful use, these graphs will quickly and easily give very good approximations with a minimum of calculations and may also suggest other areas where similar graphs may be used to advantage.

* Professor, Dept. of Mechanical and Industrial Engineering, Wayne University

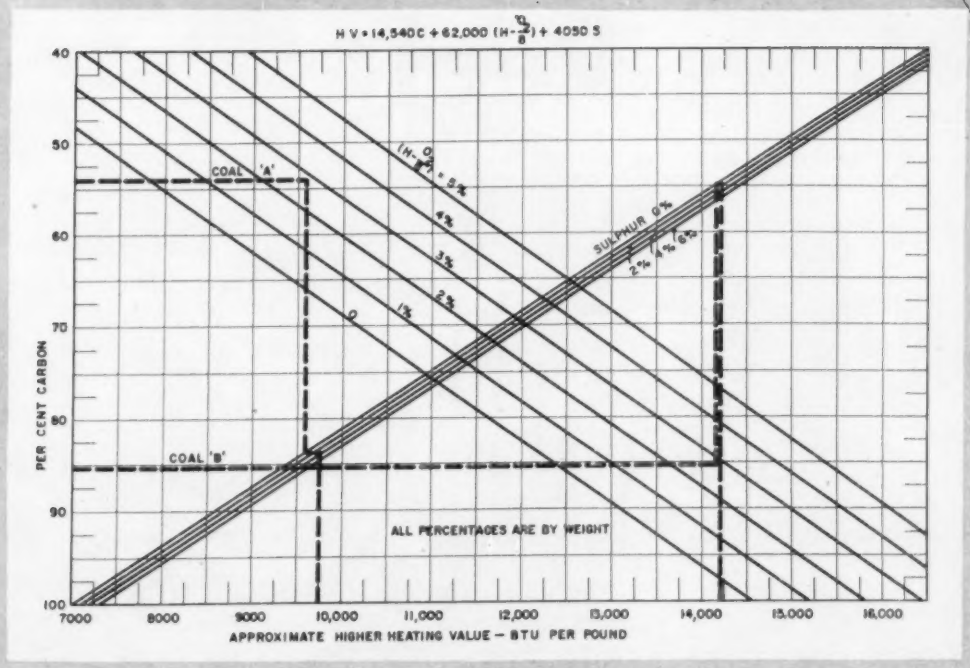


Fig. 1. The graphical form of Dulong's equation, which will give heating value within 2 or 3 per cent

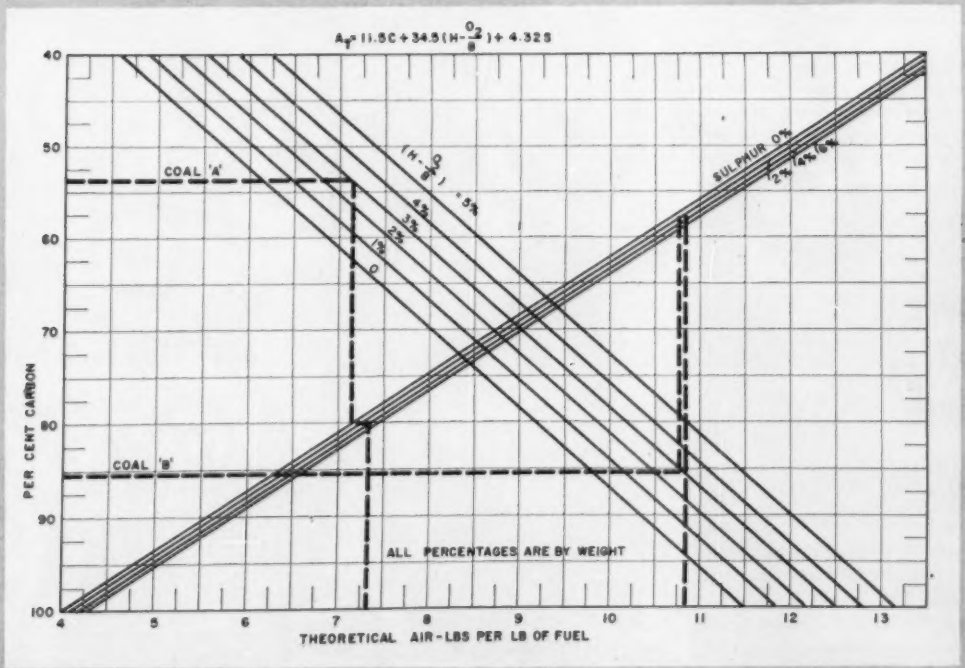


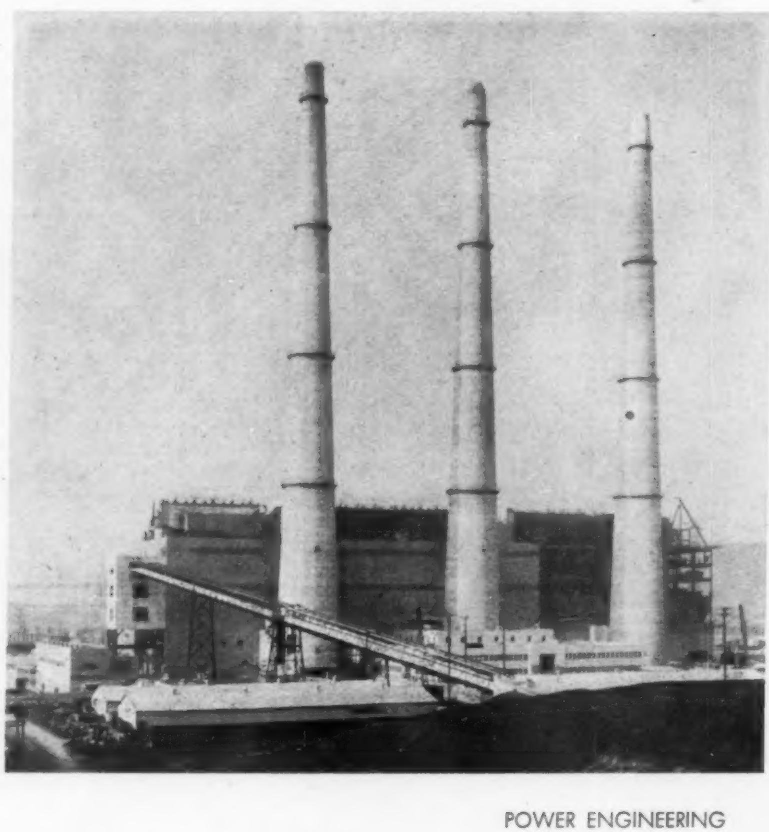
Fig. 2. The graphical solution of the theoretical air equation: $A_T = 11.5C + 34.5\,[H - (O_2/8)] + 4.32S$

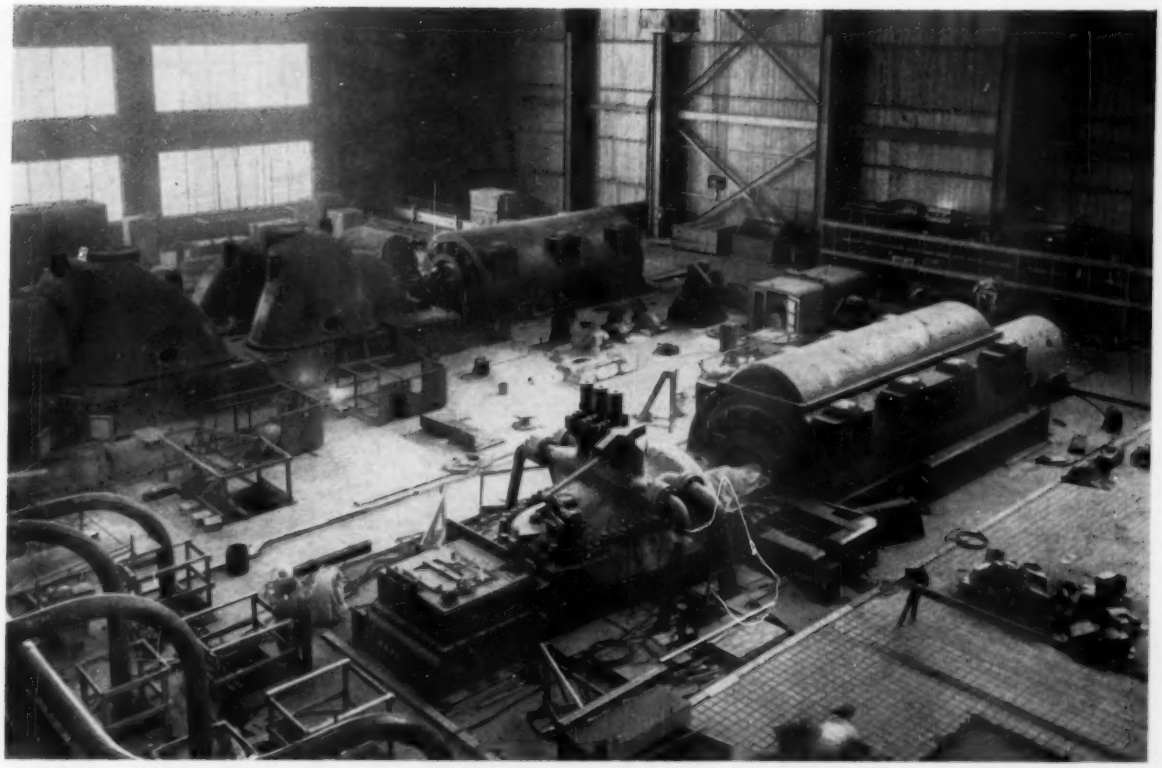
News Reel

Sodium graphite reactor being built by Atomics International Div. of North American Aviation. Southern California Edison will build and run a 7500 kw power plant using reactor heat as fuel. Reactor is located 30 miles NW of Los Angeles

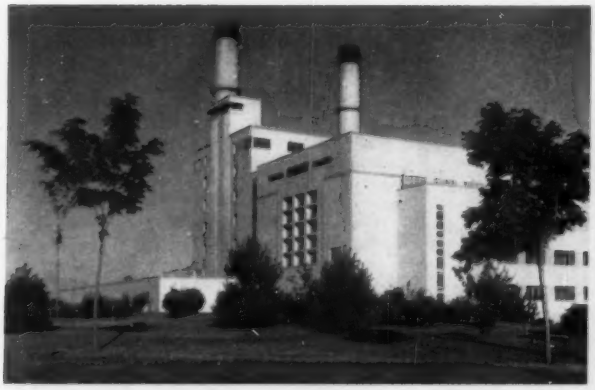
Right. New Ohio Valley Electric Corporation's Cheshire plant stacks are built to withstand atomic bomb blast. Made of reinforced concrete, they include seven large rooms in lower sections for the chimneys for housing emergency controls, switchboards and includes the water storage facilities

Above, l. to r. H. S. Day, GE instrument dept. sales mgr., Vice President J. A. Keeth, Kansas City Power & Light Co., and Dr. L. K. Kirchmayer, GE analytical engineer, with new automatic dispatching system which automatically controls load and frequency and distributes load among machines to generate power at lowest cost under conditions





Detroit Edison's newest, biggest turbine-generator set at River Rouge plant generates a total of 260,000 kilowatts. Highly efficient, the new machine will produce a kilowatt-hour of electric energy for every 7/10 pound of coal burned



(Left, above) Top national winner in Industrial Landscaping Contest; Rochester Gas & Electric's Russell Station on Lake Ontario, surrounded by new homes

(Right, above) Retired, Harold L. Hagen, inventor of airfoil fan blade in 1915, gets a gold-plated piece of original from friends at Green Fuel Economizer

(Left) The third 120,000-kw unit goes on line at Wisc. Elec.'s Oak Creek plant

(Right) Chicago's ComEd customers will soon pay their electric bills as computed by this new electronic brain system

Your Feedwater Heaters — Are They Doing Their Job?

In this practical and helpful article the author explains how to check performance of your feedwater heaters and describes the most common causes of poor feedwater heater performance

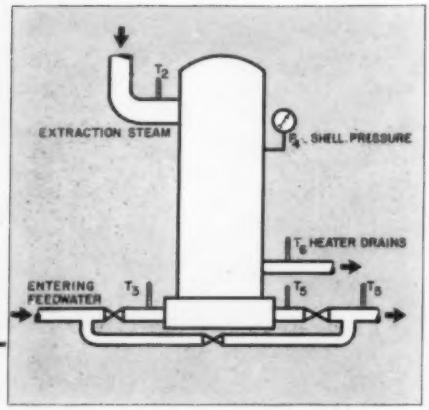


Fig. 1. Typical instrument set-up for performance test on feedwater heater

By C. B. SCHUDER*

POOR station heat rates, normally attributed to turbine or steam generator deficiencies, can often be explained by poor performance of feedwater heating equipment.

In periodic measurement of boiler efficiency, turbine heat rate, and auxiliary power use, the turbine heat rate is usually corrected only for initial and final steam conditions, which automatically charges the turbine with all deficiencies of the feedwater heating system. Separation of turbine performance and feedwater heater performance is usually not done because of the extensive data and calculations required. If such a separation is desirable, it can best be accomplished by one of the available short-cut methods. (For one method, see Simple Figuring for Minor Feed Cycle Changes by W. F. Allen Jr., POWER ENGINEERING, Nov. 1952.)

For most practical purposes, however, a measure of heater performance compared with manufacturer's guarantee will provide sufficient indication of heater deficiencies. A heater operating within two or three degrees variation would require further investigation.

A small variation from guarantee which cannot be taken care of by operating changes would require a separation of heater deficiency from turbine heat rate. The effect of this deficiency on heat rate can be expressed as an operating loss and compared to the estimated maintenance costs required to restore heater performance.

Performance

Feedwater heater performance is measured by the difference between the leaving feedwater temperature and the saturation temperature corresponding to heater shell pressure. This is known as *terminal difference* and is considered positive when the leaving feedwater temperature is below shell saturation temperature and negative when it is above. Negative terminal differences will be found only in heaters with desuperheating sections.

In heaters equipped with drain cooler sections a further measure of performance is available in the temperature difference between the heater drains and the entering feedwater. This is a measure of drain cooler effectiveness and is often called *drain cooler approach* or simply *drain cooler temperature difference*. Variations in this temperature difference have a much smaller effect on plant efficiency than an equal variation in terminal difference.

For a particular heater, the manufacturer's guarantee values for both these items can be obtained from the heater specifications or from a heat balance diagram of the cycle.

Testing

It is very desirable to conduct initial heater tests as soon as possible after a new unit has been placed in service. The heater would normally meet guarantee at this time and consequently questions regarding adequate surface and heater design could be eliminated if, on future tests, the heater performance failed to come up to guarantee. If, on the other hand, the heater would not meet guarantee at this time, then dirty tubes and other factors which are functions of service time could be eliminated from possible initial troubles.

A feedwater heater test can be conducted by one man in an hour or two with a minimum amount of instrumentation. The instruments used, however, must be extremely accurate and special care must be taken to insure that the data obtained represent exact heater conditions.

For example, a five-degree error in flue gas temperature on a boiler test might mean only 0.1 per cent error in calculated efficiency, while the same error on leaving feedwater temperature in a heater test could easily represent a 100 per cent error in terminal difference. If the test cannot be run with the proper care, it is better not to run the test at all since erroneous results can lead to unnecessary maintenance.

Heater load should be established close to guarantee conditions and should be held steady for at least one hour before the test. Heater level, routing of all heater drains, and venting should be as found in normal operation at the established load.

Essential data is as follows:

1. Feedwater flow
2. Extraction steam temperature
3. Entering feedwater temperature
4. Heater shell pressure
5. Leaving feedwater temperature
6. Drain temperature

Items (1), (2), and (3) are taken primarily to establish that the test is being conducted at conditions close to the point of guarantee although item (3) is also used in conjunction with item (6) to establish drain cooler temperature difference. Items (4) and (5), heater shell pressure and leaving feedwater temperature, are the values that require precision measurement.

Measuring Temperature

Leaving feedwater temperature can be measured with a mercury in glass thermometer properly corrected for immersion in the well fluid. A thermocouple can be used provided it is properly calibrated and the measurement made with a sensitive potentiometer. The shell pressure measurement should be made with a dead weight gauge located as close as possible to the heater shell pressure connection to eliminate possible errors in gauge head.

If a Bourdon tube gauge is used it should be checked both before and after the test and mounted so that there is no strain on the Bourdon tube. Figure 1 shows the location of test instruments. Leaving feedwater temperature should be measured inside the by-pass connection for initial acceptance test and outside the by-pass on future tests so as to include possible by-pass valve leakage in performance measurement.

* Purdue University

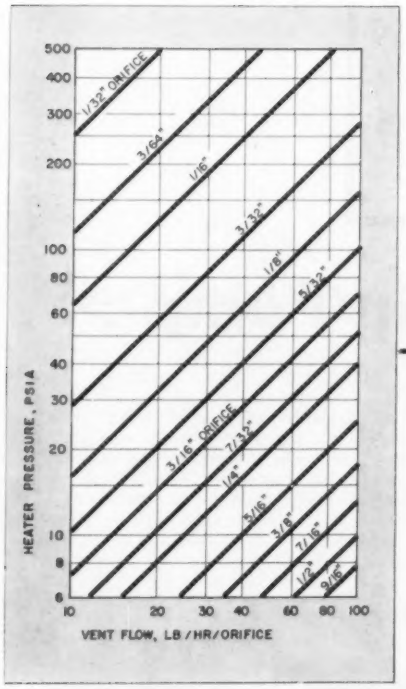


Fig. 2. Left. Vent flow and heater pressure relationship for various orifices

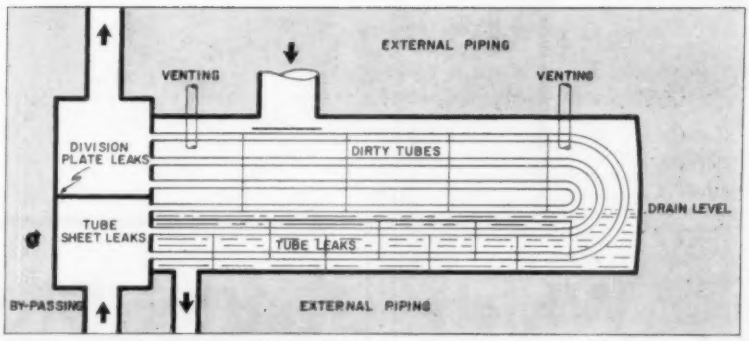


Fig. 3. Above. Check points for common heater performance deficiencies

Only a few readings are necessary but they should not be taken until temperature measuring instruments have reached equilibrium.

Causes of Poor Performance

If test terminal differences and drain cooler temperature differences meet manufacturer's guarantee, you are assured of top station efficiency from this source; if they don't come up to expectations, it's time to look around for trouble.

Insufficient Venting is by far the most common cause of excessive terminal differences. To check, open vents wide (or remove orifices if you do not use valves) for an hour or so and watch leaving feedwater temperature. Do not be misled by temperature change due to unit load variation, other heaters being cut in or out, rerouting of drains, or other system changes.

If temperature comes up, then it is a trial and error process to reset vent valves or drill out orifices to give a comfortable margin of venting over the minimum required to maintain terminal difference. Occasionally it may be found that an amount of venting sufficient to maintain terminal difference will still permit a limited amount of tube corrosion to occur from gas attack. In such cases, over-venting is necessary.

Extra venting should be provided for start-ups and for heaters operating under a vacuum. Often a heater will perform satisfactorily when operating under a positive pressure at high loads but will show an increase in terminal difference during low load operation when shell pressure falls to a vacuum. Since the amount of non-condensable gases varies from plant to plant, it is impossible to predict amount of venting that will be necessary.

If you use orifices, Fig. 2 will give you a rough idea of vent flow as a function of heater pressure and can be used to estimate flow increases for an increase in orifice size. The curves are based on Napier's formula for saturated steam and critical pressure drop which is reasonably close to heater vent system operating conditions.

Incorrect Drain Level in heaters is a rather common cause of poor performance. Heaters designed with condensate level below tubes will have a high terminal difference if operated partly flooded. Level troubles are more common, however, in heaters having drain cooler sections.

In some cases this level is rather critical; too low a level results in a drastic reduction in drain cooler effectiveness and too high a level has a similar effect on heater terminal difference. The best idea is to set level according to manufacturer's prints; then, if no improvement is noted, try varying the level slightly and watch for temperature changes in drains and leaving feedwater.

Tube or Tube Sheet Leaks can produce erratic results in both terminal difference and drain cooler temperatures depending upon the extent of the leak. If leakage is suspected, close off steam side of heater and watch for level rise or pressure increase.

Tubes which have been plugged because of leakage will not noticeably affect heater performance until the number becomes excessive. Where the number of plugged tubes is sufficient to affect results, the effect will be less pronounced on heaters designed for small or negative terminal differences than on heaters designed for large terminal differences.

External Piping can be a source of trouble on new installations where a heater does not meet guarantee on initial test. Where a heater receives flashed drains from a higher pressure heater without the benefit of a flash tank or separator, there is a possibility of excessive pressure drop in the heater resulting in leaving feedwater approaching saturation temperature of the lower rather than the higher pressure.

Check with a pressure gage near the steam inlet and drain outlet correcting for any head of water on the outlet gage due to condensate level in heater. The pressure difference should be negligible. Plugged drain lines, obstructions or blank orifices in drip pot and heater vent lines, flash tanks not hooked up for proper steam-water separation, and vortex formation in drip pots are other likely contributors to poor performance.

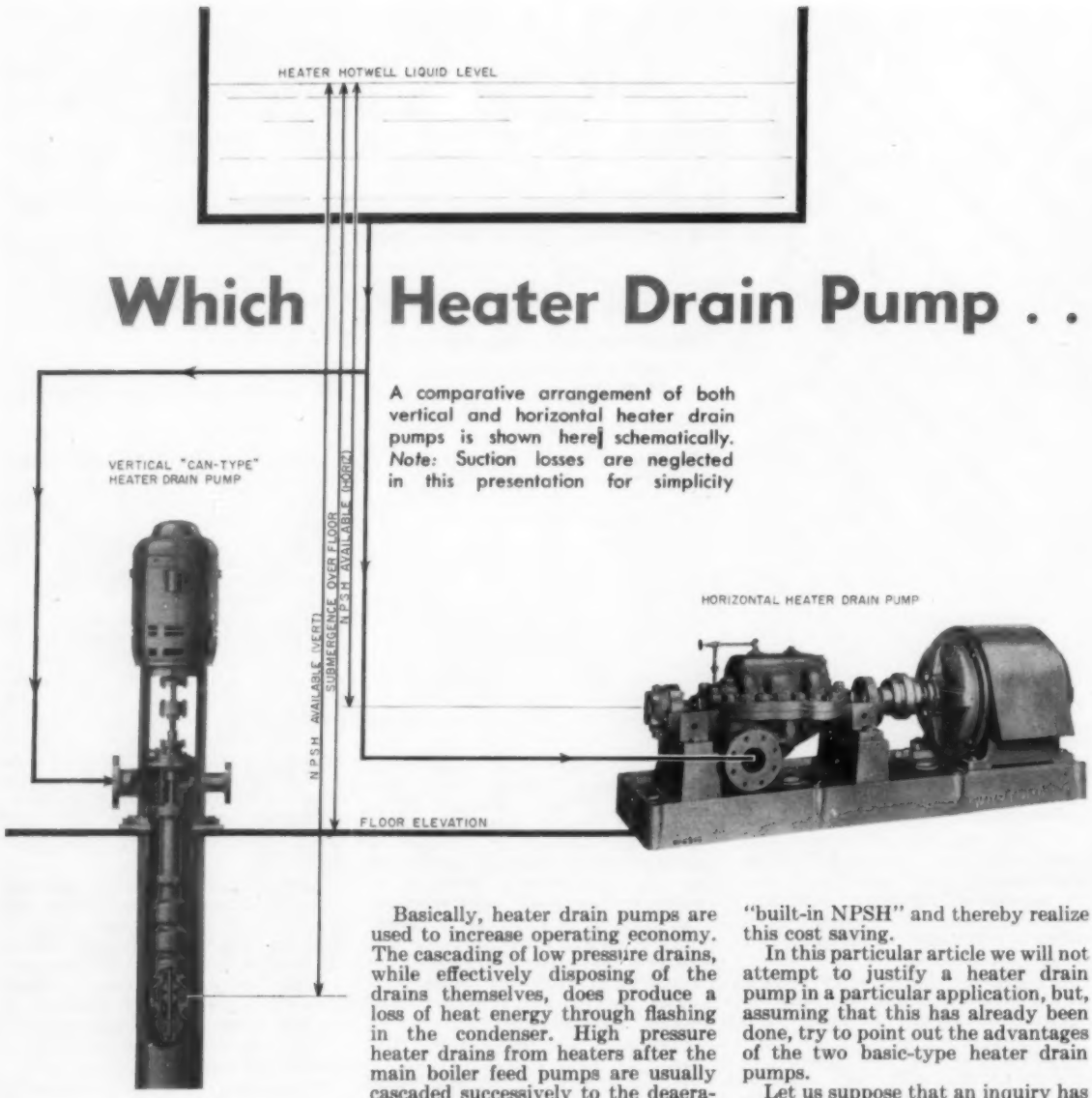
Dirty Tubes are the most common cause of deterioration of heater performance. If a heater has met guarantee at one time and then fails to do so at a later date with adequate venting and proper level, it is likely that tube deposits have occurred. If, on inspection, even a light deposit is noticed, it is advisable to clean the heater and retest.

By-passing, either externally through the by-pass valve or internally around the water box division plates, is another source of poor performance that may appear in time. Detection of internal by-passing, like dirty tubes, requires an internal inspection. Even though the pressure drop across these plates is low, leakage can be detected by the appearance of water cuts on the edges of the plates.

WOULD YOU LIKE TEAR SHEETS?

Readers wanting tear sheets of any article appearing in the issue for their personal file may obtain them by indicating the item desired on one of the post cards appearing in this issue—Editors.

Which Heater Drain Pump . . . . .



A comparative arrangement of both vertical and horizontal heater drain pumps is shown here schematically. *Note:* Suction losses are neglected in this presentation for simplicity

By T. W. EDWARDS*

IN THE DESIGN and construction of modern high pressure steam electric generating stations, there is a constant effort to improve heat rates and reduce construction costs. This effort has produced a particular pump application — the heater drain pump; which, while not new, is not thoroughly understood by some designers and operators. It is the intent of the author to explore this application, pointing out various partially hidden aspects of this particular service as applying to the type of pump employed. It is hoped that the reader will, as a result, become more familiar with the various types of heater drain pumps available today and be in a position to choose between these alternate arrangements.

Basically, heater drain pumps are used to increase operating economy. The cascading of low pressure drains, while effectively disposing of the drains themselves, does produce a loss of heat energy through flashing in the condenser. High pressure heater drains from heaters after the main boiler feed pumps are usually cascaded successively to the deaerator under normal station load conditions.

During periods of light load operations, however, the static head to the deaerator may exceed the available pressure differential. Unless a pump is employed under these conditions, the drains will usually have to be switched to a lower-pressure closed heater in order to cascade effectively. These losses and operating complications can be largely eliminated if the drains are pumped to their final point of disposal rather than cascaded. Of course, the cost of pumping equipment and horsepower consumed reduces the gross gain but usually leaves enough net gain to make the use of heater drain pumps worthwhile in many instances.

In an effort to reduce heater elevation and hence reduce cost, there has been a marked tendency towards the use of so-called can pumps, to acquire "built-in NPSH" and thereby realize this cost saving.

In this particular article we will not attempt to justify a heater drain pump in a particular application, but, assuming that this has already been done, try to point out the advantages of the two basic-type heater drain pumps.

Let us suppose that an inquiry has been sent out covering two heater drain pumps. Capacity and head have been specified and minimum NPSH requirements requested. Several bidders have offered both horizontal and vertical alternates. Let us examine these two alternatives in detail, see what differences exist, and determine how important these differences actually are to us.

First Cost: First cost is important. Here the vertical can type heater drain pump will probably have a definite advantage. The initial saving may actually be quite considerable and may tend to make us look with little favor at the high-priced horizontal alternate.

Efficiency: This general picture may be sustained when we look at comparative efficiencies. As a rule here, differences will be slight and if

*Harrison Pump Div., Worthington Corp.

. . Vertical or Horizontal?

any, favor the vertical construction.

Submergence Requirements: When we compare submergence over floor level required, however, we see a tremendous difference. The horizontal pump may require 15 ft or even more, depending upon its speed and capacity. After all, the conditions of service for which a heater drain pump may be applied today can make the use of a moderate-pressure boiler feed pump appropriate.

The vertical heater drain pump alternate, however, can usually be built to require no more submergence than is readily available with the heater set at the lowest elevation possible. If desired, a required submergence of 0 at floor level can be had readily. This is attained, of course, by merely setting the first stage impeller at a low enough elevation so that the required NPSH becomes equal to, or less than, the difference between the impeller elevation and floor level. This is the basis of saying that a can pump has "built-in NPSH." Here, therefore, the can pump shines.

As far as space requirements are concerned, a vertical pump requires much less floor area than a horizontal pump. Therefore where floor space is at a premium, the can pump shows up well. In this same vein, the location of the motor may be important from the point of view of flooding. With a horizontal pump, the pump and motor must be at the same elevation, which of necessity must be low in order to provide sufficient NPSH for successful operation. In the vertical can pump however, the motor may be located on almost any desired level to protect it from possible water damage.

So far the weight of evidence is very strongly in favor of the vertical can-type heater drain pump. It is cheaper; it requires less submergence; it takes up less floor space; it can be built to be flood proof. . . . *But*, there is one more aspect of these two alternate heater drain pump arrangements which — depending on local conditions — can far outshadow all these advantages combined and then some.

Maintenance: A horizontal heater drain pump is, by arrangement, easily inspected. It can be opened up with a minimum of effort. Normal maintenance can be accomplished on a horizontal heater drain pump without touching its suction and discharge connections or moving its driver. On the other hand, to inspect a vertical can-type heater drain pump, one must usually remove the motor, disconnect the piping, and then withdraw the entire pumping element from the can. This is a costly and time consuming process.

Let us look at a few more aspects of this maintenance problem as applied to a vertical versus horizontal heater drain pump.

Bearing Life: A horizontal heater drain pump is usually provided with oil- or grease-lubricated bearings of the sleeve or antifriction type. These bearings, of course, are external to the pump itself and can be inspected and maintained without disturbing the pumping element. They are by nature comparable in life expectancy and reliability to main boiler feed pump bearings. On the other hand, a vertical can-type heater drain pump usually has one or more bearings which are lubricated by the heater drains themselves.

The lubrication qualities of these drains are poor when compared to oil. This is especially true in heater drain service since the drains are at, or near, saturation conditions — which may be at elevated temperatures as well. As will be mentioned later, severe hydraulic operating conditions can adversely affect these already questionable lubrication qualities. Therefore, the life expectancy of these water lubricated bearings is probably on the order of 20 to 40 per cent of the life expectancy of the oil- or grease-lubricated bearings used in the horizontal heater drain pump.

Operation during Load Change: In a horizontal heater drain pump, the bearings are completely divorced from the liquid pumped and lubrication is not dependent in any way upon hydraulic operation. Not so with the vertical can-type pump which depends almost exclusively upon the lubricating qualities of the drain themselves. During a severe load drop the heater drain pump may flash in its first stage impeller. Bearings in this zone then run dry and may fail instantly as a result. Even if they do not fail immediately, they most surely will have been damaged and their life drastically reduced. The danger of pump seizure during rapid load changes can be intimately tied to shaft spans. In the horizontal pump, the shaft span is usually quite short when compared to a comparable vertical heater drain pump.

Actually, the length of a vertical can-type heater drain pump may be several times the length of a horizontal pump for the same operating conditions. Granted, the span between bearings in a vertical pump may be much less due to a multiplicity of bearings. However, when a shaft is running in many bearings, alignment frequently becomes a matter of larger running clearances rather than an ultra-high degree of accuracy in bearing setting. We see, therefore, that while the vertical heater drain pump has many initial advantages, the maintenance problem is vastly increased. This can completely negate the apparent advantages of a vertical construction and eliminate it from consideration.

These adverse factors, however, should not exclude the vertical can-type heater drain pump from consideration in purchasing equipment for a central steam-electric generation station.

Occasionally, an existing station is to be modified and heater elevations are fixed. In this case, a heater drain pump of the vertical can-type may be required in order to provide adequate operating NPSH. Also, the matter of flood protection is, in some localities, of extreme importance. Here, a vertical heater drain pump is much more adaptable.

Temperature Is Factor

Since much of the maintenance troubles attendant on a vertical can-type heater pump are, to a degree, a function of operating temperature, the choice between a vertical heater drain pump and a horizontal heater drain pump can be largely a function of operating temperature. In other words, low-pressure heater drain pumps with operating temperatures of 200 F or less can be more safely built in the vertical can-type construction than can high pressure heater drain pumps with operating temperatures of 300 F or over.

The choice, therefore, is an individual one, and no hard and fast rule can be drawn. It is important, nevertheless, that the operator recognize that operating differences exist. He must appreciate that he is buying NPSH, and may possibly pay for it through maintenance. His first cost may be cheaper and his space requirements less, but the degree of reliability is certainly reduced. Whether he can tolerate this is up to him. It is only important, however, that he know all sides of the matter so that he can make the proper decision.

Why Bother With Scaffolding?

Many engineers may not be aware of recent developments in man-lifting devices. Photos here show applications in field of power distribution, and they give an idea of money that can be saved on jobs normally requiring a fair amount of rigging and scaffolding

Fig. 1. Traffic blocks are avoided by using hydraulic boom for man-lifting

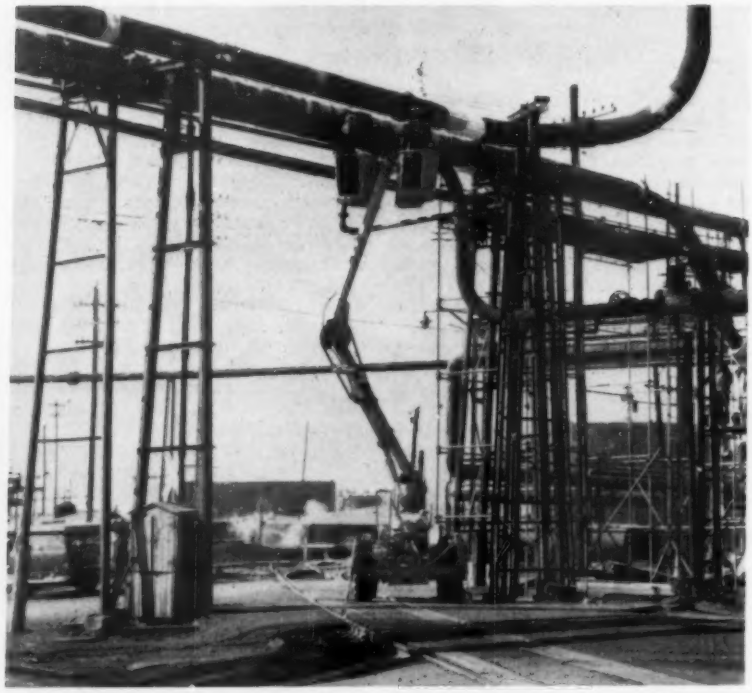


Fig. 2. Repairs to power lines, piping and other overhead equipment can be made without losing time for rigging or scaffolding and without blocking plant traffic

Fig. 3. (Above) Line clearance and tree trimming are easy with man 45 ft up

Fig. 4. (Above) With this long overhanging arm highway traffic is not impeded when power lines need repair

Fig. 5. (Right) Two crow's nests enable two men to work together easily

For the photographs on these two pages we are indebted to Maxwell Equipment Company, Mi-Jack Products Inc., and J. H. Holan Corporation.

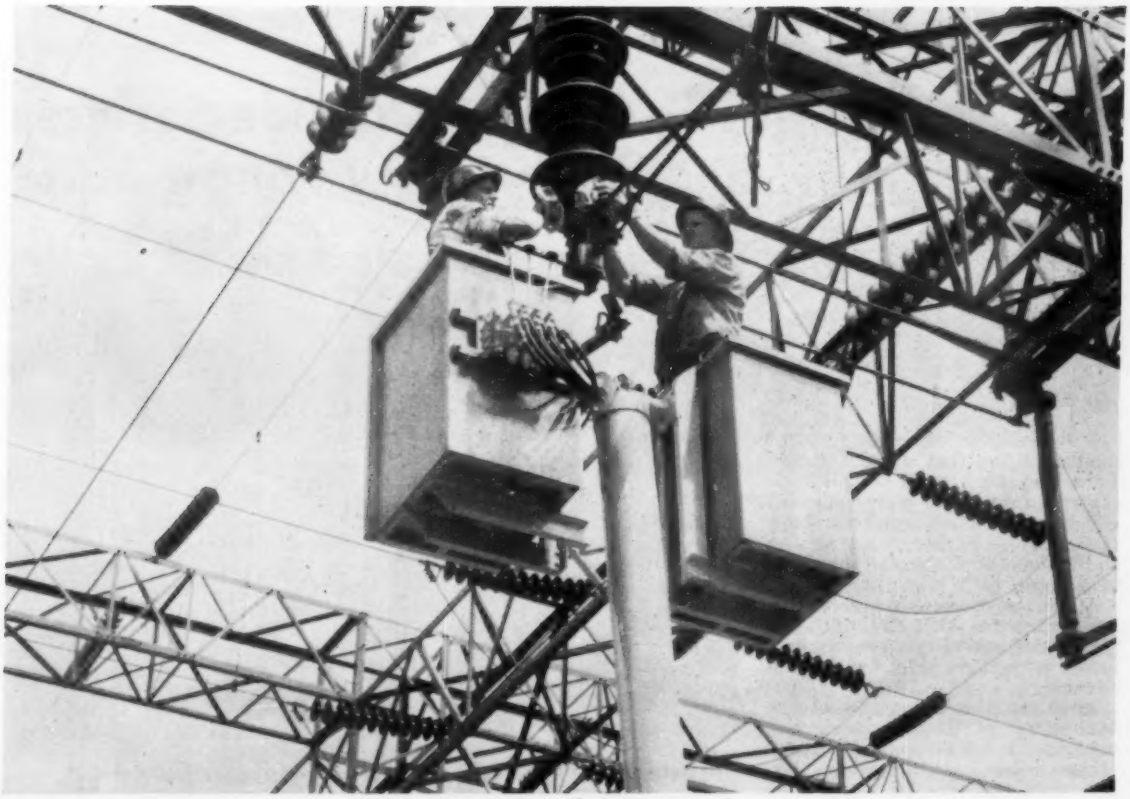


Fig. 6. Hours of rigging labor can be avoided in substation work. Hoist is controlled from the crow's nest, made of fiberglas. Boom can be insulated for safety

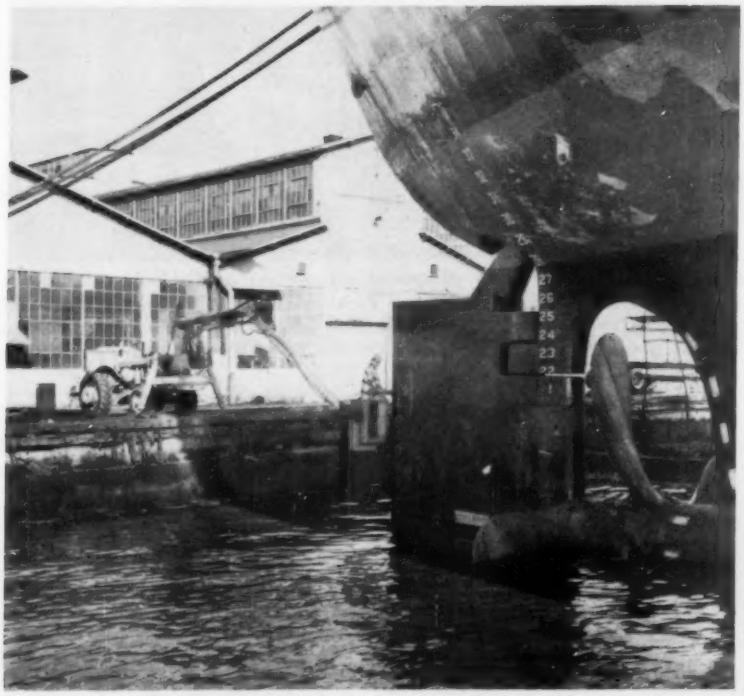


Fig. 7. (Above) Application shows unusual flexibility of man-lifting hydraulic boom

Fig. 8. (Right) Another hydraulically operated man-lifting boom—telescopic type

Utilities Use More Outside Services . . . . Should Industry Follow Suit?

BY FRED M. REITER*

THERE IS a growing trend among large and small utilities to contract with outside organizations for the performance of service and maintenance work formerly done exclusively by the company itself. There are several reasons for this, but regardless of the causes, many companies find that it pays to hire crews who specialize in certain fields or services. These crews are composed of men who have learned the work thoroughly — usually at a utility — and found it profitable and satisfying to set up their own independent concerns to operate over a wide territory. When one job is completed, the entire crew moves into another area ready to start on work lined up in advance.

Most utilities are aware of the availability of these services, and many make use of them. Industrial plants, however, have less acquaintance with this type of organization and it appears feasible that a number of the larger plants might find it profitable to consider hiring out on contract much of the maintenance work now performed by company personnel.

An example of the way in which one utility uses contract services is The Dayton Power & Light Co. Some utilities use more, others, less; or, they may use whatever other particular services are available in their area. In any event, here are some of the ways our company utilizes independent contractors.

There has always been diversity of opinion among utilities regarding inspection of treated poles, cross-

*Fuel Engineer, The Dayton Power & Light Co.

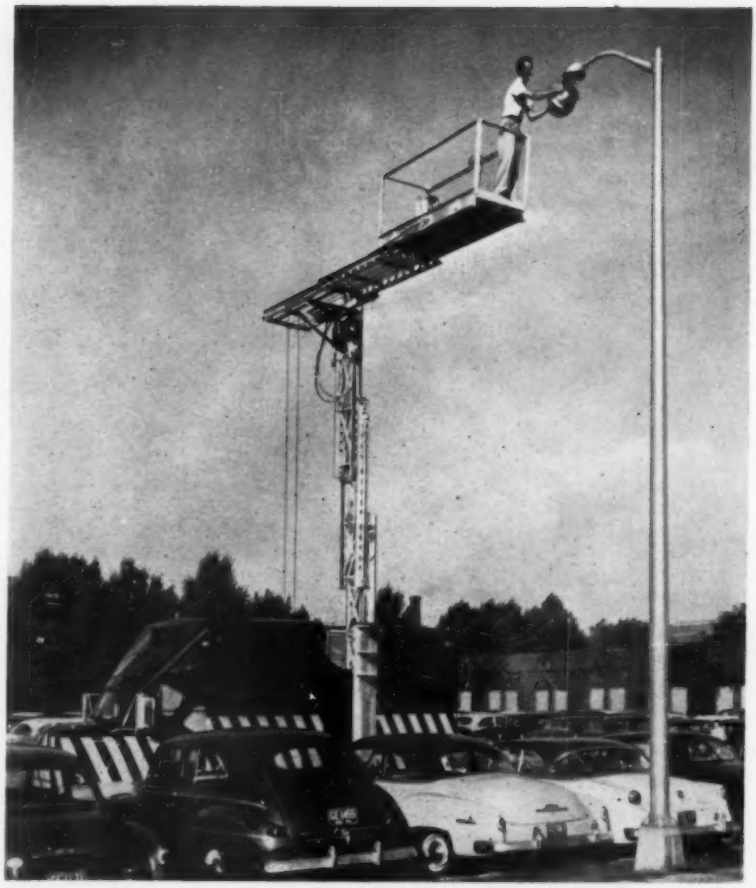


Fig. 1. Here is an example of specialized services available in some areas to utilities and industry. Ingenuity and know-how combine to make efficient unit for cleaning street lamps on production line basis. Platform raises and lowers quickly; glasses are washed within truck and dried by infra-red light on rack

Fig. 2. Inspection of transmission line poles by contractor begins with boring hole at ground line to test for rotting

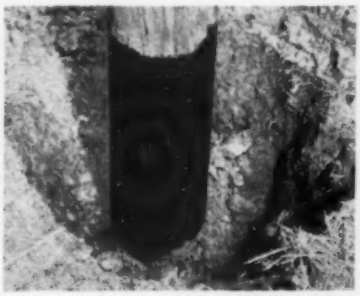


Fig. 3. Sound poles are coated with a creosote preservative that is absorbed into wood, adding at least 7 yrs life

Fig. 4. Preservative is covered over with a heavy coat of coal tar applied evenly with either a spatula or trowel

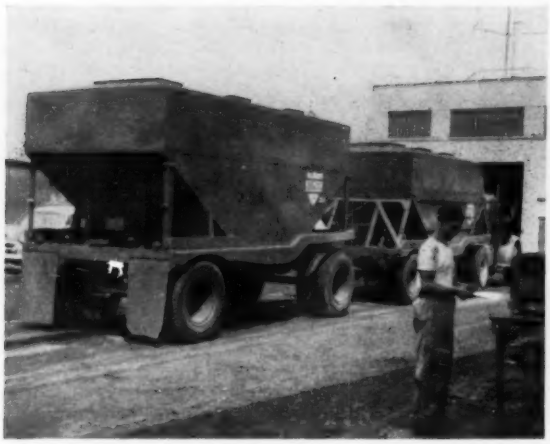


Fig. 5. Bottom-pour, double-trailer truck for coal delivery

Fig. 6. Tandem trailer holds 17 tons, hauls ashes on return

arms, ties, and timbers by commercial inspecting firms. Railroads seem to have favor using their own employee inspectors, as do the telephone companies. Power utilities appear to favor outside inspection.

Our company has found that commercial inspection suits their needs at a saving in time, discussion, and money. High quality wood products are received by us. Rejections and returns are nil at the ultimate destination — where the cost of the wood treatment and freight are maximum. After erection in the field, failure of poles or wood products becomes very expensive.

The commercial inspection companies have inspectors located at all treatment centers. Travel costs are avoided. The cost of outside inspection is about one per cent of the cost of the wood purchased. Since we have no qualified inspectors of our own, outside inspection fulfills our needs adequately.

The removal of cinders and even wet fly ash from smaller steam and power plants frequently becomes a problem. If the dump is a considerable distance from the plant, removal costs may become sizeable.

Plants that use their own vehicles for hauling these ashes may be spending more for this operation than they think, or than they need to. They may not have the proper size or type of trucks. The average size of dump trucks used by most plants carries 5 tons.

At one time we hauled fly-ash several miles using our standard 5-ton dump truck. We now have our cinders hauled away in 17-ton-capacity trucks. Not only does this trucker haul our cinders away with economical transportation equipment, but he found block manufacturers in need of cinders. We now get paid a small sum per ton of cinders that our outside trucking firm hauls from our plants. Through his enterprise and acumen, along with his need to keep his trucks in operation, we turned a nuisance and cost into a small profit — with very satisfactory removal operations — clean, prompt, no fuss or nuisance.

This trucker also hauls coal to one of our power stations on his return from the delivery of cinders to plants adjacent to the Ohio River. This coal haul reduces our transportation costs because of his round-trip pay load.

Another service we recently adopted is a type currently representative of many new "home" services — our supply of rags. We used to buy bulk rags and waste from various sources. We received knit scraps, cheesecloth, sugar bags, and all kinds of mill-ends and remnants; white, bleached, or colored. At times these rags were very poor in quality and usefulness — often skimpy and irregular. We had four industrial sources of these rags and would switch in order to improve the quality offered to us.

A study of a commercial towel rag service indicated that on the basis of 20,000 rag towels per month, up to $1,250 could be saved each year. We figured that since new rags cost us about 40 cents per lb, washing 7 cents per lb, our overall rag cost for the year of 1948 was 24.1 cents per lb. On the other hand, one hundred 15- by 18-in. towels (8.8 lb), cost us $1.40 or 16 cents per lb. The 18- by 26-size (15¼ lb) cost $2.00 per 100 or about 13 cents per lb.

The quality of the commercial towels was excellent, size was uniform, and they were easily distributed and accounted for — the identity of the supplier being stamped indelibly on each one. Handling and return of these well-made towels was simplified so that loss and waste became negligible. Since we did not own the towels, inventories, property accounting, taxes, and similar work and responsibilities were eliminated entirely. The whole job of handling cleaning rags was simplified and reduced in cost.

Lengthen Life of Poles

Many utilities inspect their transmission lines and poles in lines approximately 25 years or more in age. They are inspected for rot, insect or bird damage, or other possible failures. The most rapid decay occurs at the ground line where moisture in the topsoil reacts with air to promote the growth of fungus, bacteria, and insects. These may cause premature weakness in the standing pole. A 55-ft pole delivered to the spot, erected, cross-arms and wire mounted, will involve a gross investment of over $150.00.

The life of that pole should extend to 40 years. If it must be replaced at the end of 25 years, its cost has been $6.00 per year. If it lasts 40 years, the annual cost will have been $3.75.

If these poles were accorded a normal life expectancy of 25 years, each year added beyond 25 means a saving of $6.00 per pole, besides postponement of the assignment of crews, vehicles, and material to do the replacement job. They could be doing other work of perhaps greater importance because weakened poles would probably fail during heavy storms when there are plenty of other troubles to take care of.

There are firms that inspect pole lines, drill into the butts of all poles for thickness of sound wood, examine

Figures 2, 3, 4, and 7 courtesy Barrett Division, Allied Chemical & Dye Corp.

Fig. 7. Both coatings are covered by heavy paper to assure continued penetration, prevent abrasion of coatings

Fig. 8. Cheap rags are seldom economical; loss and wastage cut value. Ever try wiping off grease with old silk dress?

Fig. 9. Use of industrial wiper and towel service provides good cloths, prevents waste, loss, saves inventory expenses

the above ground surface of the pole for shell rot. They submit a complete report on whether poles are individually losing strength and should be treated or replaced completely. They will then, on order, send a full crew out to give ground-line preservative renewal treatment, or spray the above-ground surface to stop further shell rot. Life of poles can be extended 7 to 20 years by each treatment.

Treatment Cost Is Nominal

The cost of treatment is nominal, from about $4.00 for ground-line treatment to about $13.00 for top spraying per pole. They have all trucks and equipment to do the job efficiently and speedily. It is their specialty, and they can do a lower-cost job than can our own crews.

We find it best to go to these firms and contract for them to do the entire job on the poles which they have inspected and recommended treatment. We consider each complete transmission or distribution line separately on its own merits. Many utilities do this work themselves. We look upon the use of outside service as the preferred procedure.

The advantage of the utilization of outside crews for tree trimming is not as easily determined as other operations. Here again, one can utilize these special skills and equipment required for this job. There are many organizations composed of technical tree surgical men who have trucks especially designed for this work.

The crews are trained to protect the trees from excessive disfigurement and from harm. Where complete lines have vegetation on considerable of their lengths, it becomes a paying proposition to consider the employment of these tree trimming services on a contract basis.

However, because of the many isolated cases of tree interference that become acute quickly or are reported by customers, tree trimming is constantly being done by regular line crews. These are more in the nature of emergency jobs.

Tree trimming in the better residential sections requires care and "gardening" experience. There is a definite esthetic angle. Trees are objects of beauty to great many owners so that criticism and problems can arise when a poor "tonsorial" job is done. Outside-trained tree "barbers" must exercise greater care and responsibility in order to get continuous business.

The ownership of laboratory facilities is a matter of economics and convenience. Most large utilities and industrial plants maintain their own chemical and physical testing laboratories. Our own Company has four steam power plants burning a total of more than one million tons of coal per year. Our two outlying power stations use their own chemical laboratories for coal, water, oil and similar analyses. Our two in-town steam plants use the facilities of a down-town commercial laboratory to whom samples of coal are sent three times each week. We do all of our own water testing.

The economics and convenience of this outside laboratory service might be questioned. Under a large volume order, the cost of this service may be no higher than the intra-company inter-departmental costs of the laboratory and sample handling operations of the utility, as allocated by the cost accounting department.

This is not an unusual situation in large industrial establishments. It is common practice among large automotive and other industries to bid for and purchase parts and services at lower costs than could be procured from within their own organization.

We send our purchased parts and materials to a commercial laboratory located within our area. This procedure has been very satisfactory from every view point; we get speedy service, neat reports at low cost that are certified by experienced registered professional engineers which gives us factual data acceptable to courts or engineering conferences.

The use of outside contractors for washing and cleaning the glass covers on street lights is fairly new. A firm in our area has developed a special truck whose platform rises quickly to the height of the lamp; the operator on the platform has his tools, clean glasses, globes, and parts. The interior of the truck is fitted with washing and infra-red drying equipment for the glasses — practically a production line on wheels. With this truck, the contractor cleans about 30 units per hour, replacing all lamps as he goes, in line with our preventive maintenance program.

We estimate that the contract cleaning cost is about one-third of our own gross costs of doing this job. In 1955, about 10,000 lights in our city area were cleaned for the same money that it cost us to clean 4000 lights in 1951. [*Editor's note:* A complete story on this ingenious lamp-cleaning truck will appear in a future issue of POWER ENGINEERING.]

High-Voltage Work a Specialty

In the outside-construction field, there are other contractors who have developed efficient crews to go down the line with their special costly equipment to do the big jobs that once were exclusively the province of the utility. This was especially true where high-voltage work was done.

The special contractors have the advantage of a high load-utilization factor of their expensive equipment. They contract for entire transmission lines, erect the poles, pull the wires, mount the cross-arms and gear on the poles — do the whole job. They carry their own insurance of all kinds, preach safety, and assume all responsibility. The utility furnishes the materials.

Contract line work has expanded at an accelerated rate until our line construction contracts now comprise about 50 per cent of our total.

The examples discussed here were selected at random to illustrate the importance of outside services to modern industry. The service field will continue to grow as active people with initiative develop better methods of doing work long performed by the companies themselves — and often in ways devised years ago.

Fiber-Glass . . . Power Pole of the Future

You'll be hearing more about these poles—one fifth the weight of wood, with the strength of spring steel, extreme flexibility, impervious to moisture, corrosion, vermin, termites, woodpeckers . . .

LIKE MOST GOOD IDEAS — you wonder why it hasn't been done before. The combination of strength and lightness so successful in glass-fiber auto bodies and fishing rods has now been applied to make an impressive alternative to wood for power and telephone poles.

For more than a year Consumers Power Company has tested a line of these poles in normal service on its system in Michigan and the results have been very satisfactory.

The poles (and cross-arms) are made of glass-fiber laminate bonded with epoxy resin to form tubular columns. The laminate is made with phenolic impregnated Kraft paper and glass fibers with a tensile strength up to 100,000 psi.

This is the processed strength — unprocessed glass filaments have strengths in the 800,000 psi class — the strongest material known to man. The bond is epoxy resin, the strongest man-made adhesive, classed electrically with the melamines, and having compressive strengths up to 20,000 psi.

The tube is made in continuous unjointed lengths without taper, and with a thin, tough, smooth exterior. Both yield and ultimate strengths of these poles are in the same class as spring steel, and due to their extreme flexibility there is no permanent set or distortion under heavy loading.

Fiber-glass poles can be built to precise standards of strength because the strength of each fiber is known. This is quite different from wood poles, whose strength depends on rainfall, sunlight, density and other things. One result of this variable nature of wood is that we have to design wood poles for large factors of safety, which means most wood poles are bigger than they need be. Glass-fiber poles, on the other hand, can be designed accurately, without waste.

In addition to the advantage of the smooth surface of glass-fiber poles in preventing build-up of contaminants, there are no cracks in which water can be trapped and possibly freeze, and the smooth surface prevents woodpeckers and squirrels from getting a foothold. The material is highly resistant to impact, even after immersion in freezing water at -30F.

A 35-ft fiber-glass pole, 11 in. diam, weighs only 150 lb, compared to about 750 lb for the equivalent wood pole. The advantages of this lightness for handling are enormous. Two men can lift a 35-ft pole with ease, and cross-arms can be carried in bundles of three by one man.

Electrical tests show properties as remarkable as the mechanical ones. On impulse flash-over tests, an average of 11 shots with 2000 amp surge crest on a dry fiber-glass arm was 360 kv crest, with no visible damage. Same test on southern yellow pine arm averaged 360 kv crest with splintering of surface and grain.

Six shots of 20,000 amp on a dry fiber-glass arm caused no damage until the sixth shot, when a ¼ in. strip was torn from outer ply only. One shot of 20,000 amp on a southern yellow pine arm shattered it into three pieces.

Such remarkable test results lead to interesting speculation about the need in future for porcelain insulators, since the whole pole and arm have such high resistance.

There are two main methods of fixing the cross-arms. One is to use metal gains to attach the cross-arm to the pole. The other is to drill a hole straight through the pole and pass the cross-arm through the hole. This latter arrangement, without any external bracing or hardware, gives a strength equivalent to a braced cross-arm.

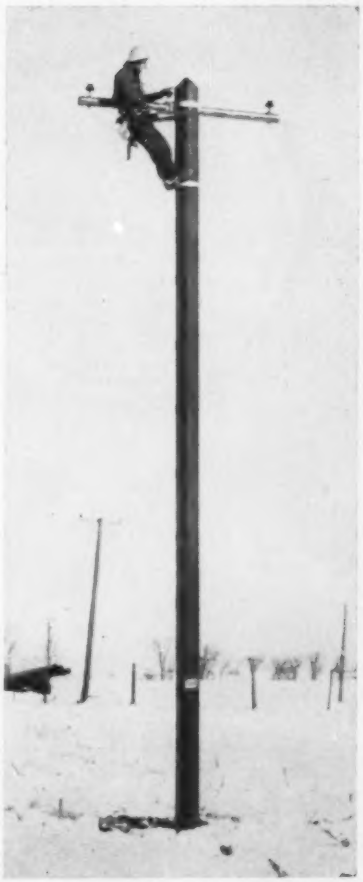
The pole is climbed by means of metal steps set in holes in the pole. Permanent steps start some way up the pole to avoid danger of children climbing. For the lower step, the lineman inserts steps as he climbs and removes them as he descends.

Another possible advantage of fiber-glass poles is that extensions to existing poles could be made very easily by means of a collar and plug plus a stub section.

Fiber-glass poles need no treatment; they are inherently resistant to atmosphere and ground corrosion.

At present, these poles and cross-arms run about three times the cost of equivalent wood poles. However, this figure is likely to fall considerably as production increases. Even at present prices there are many situations where the great advantages of fiber-glass poles would make their overall cost lower than that of wood poles.

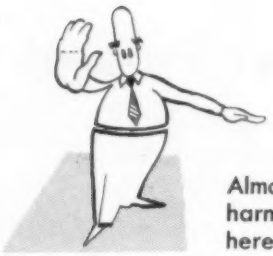
A southern power company, suffering extensive damage from the ravages of the pileated woodpecker, estimated that it cost as much as $1000 to get in and replace a damaged pole in some of their swampy areas. For situations like this the actual cost of the pole is a very small item. And even for more normal lines, the actual pole cost is often only a very small part of the total cost of handling, storage, freight, replacement, installation, maintenance, etc.



Lineman on a new fiber-glass power pole preparing to string conductors

When we consider that there are approximately 100,000,000 poles in this country, with an annual installation rate of 5,000,000 and replacements at the rate of one in five, it can be seen that fiber-glass poles, with an estimated life of more than 50 years, can mean large savings of money.

The franchise for distribution of these poles in this country has been granted to Line Materials Company. The poles are manufactured by Gar Wood Industries, and they were tested under service conditions by Consumers Power Company. The latter company has worked closely with both firms in the development of this revolutionary new product.



Save That Floor!

Almost any deteriorating substance can be rendered harmless, provided you know how to deal with it. Data here tells how to combat all normal damaging agents

UNDER CERTAIN CONDITIONS concrete floors require special treatment to prevent damage to the surface. The more common treatments for protection against the more common damaging substances are listed here. The numbers listed in the data sheets refer to the numbered treatments given in the text. In almost every case more than one treatment is suggested in the data sheets. Any one of these treatments will provide sufficient protection for the concrete in most cases, but the other recommended treatments will be equally suitable. In making a selection, economy should be considered. Where continuous service over long periods is desirable, it may be economical to use the more positive method of control rather than those of lower first cost which are apt to be less permanent.

Treatments

1 Magnesium Fluosilicate or Zinc Fluosilicate. The treatment consists of two or more applications. First a solution of about 1 lb of the fluosilicate crystals per gallon of water is used. For subsequent applications about 2 lb of the crystals per gallon of water are used. Large brushes are convenient for applying on vertical surfaces, and mops on horizontal areas. Each application should be allowed to dry. After the last one has dried, the surface should be brushed and washed with water to remove crystals which have formed. The treatment hardens the surface by chemical action and makes it more impervious. Fluosilicates are available from chemical dealers.

2 Sodium Silicate (commonly called water glass). This is quite viscous and must be diluted with water to secure penetration, the amount of the dilution depending on the quality of the silicate and the permeability of the concrete. Silicate of about 42.5 Baumé gravity diluted in proportions of 1 gal with 4 gal of water makes a good solution. It may be applied in two, three or more coats, allowing each coat to dry thoroughly before applying the next one. On horizontal surfaces it may be poured on and then spread evenly with brooms or brushes. Scrubbing each coat with water after it has hardened provides a better surface condition for application of succeeding coats. For tanks and similar structures, progressively stronger solutions are often used for the succeeding coats.

3 Drying Oils. Boiled or raw linseed oil may be used, but the boiled oil dries more rapidly. China wood oil or tung oil and soybean oil are also effective. Applied hot, better penetration is secured. The oil should be applied immediately after heating, however, as it will become more viscous if allowed to stand. Two or three coats may be applied, allowing each to dry thoroughly before the next application. Diluting the oil with turpentine up to a mixture of equal parts gives a better penetration for the first coat. The concrete should be well cured and seasoned before the first application. The oil is sometimes applied after the magnesium fluosilicate (1) treatment, providing a good coating over a hardened surface.

4 Cumar. Cumar is synthetic resin soluble in xylol and similar hydrocarbon solvents. A solution consisting of about 6 lb of Cumar per gallon of xylol with ½ pt of boiled linseed oil makes a good coating. Two or more coats should be applied. The Cumar should be powdered to aid in dissolving. It is available in grades from dark brown to colorless.

5 Varnishes and Paints. Any varnish can be applied to dry concrete. High grade varnishes of the spar, China wood, or Bakelite types and synthetic resin paints and coatings, or paints consisting largely of chlorinated rubber or synthetic rubber give good protection against many substances. Two or more coats should be applied. Some manufacturers can provide specially compounded coatings for certain conditions.

6 Bituminous or coal tar paints, tar and pitches. These are usually applied in two coats — a thin priming coat to insure bond, and a thicker finish coat. The finish coat should be carefully applied to secure continuity and avoid pin holes. The surface should be touched up where necessary.

7 Bituminous enamel. This is suitable protection against relatively strong acids. It does not resist abrasion at high temperatures. Two materials are used, a priming solution and the enamel proper. The priming solution is of thin brushing consistency and should be applied so as to cover completely. Any uncoated spots should be touched up before the enamel is applied. When the primer has dried to a slightly tacky state, it is ready for the enamel. The enamel usually consists of a bitumen with a finely powdered siliceous mineral filler. The filler increases the resistance to flowing and sagging at elevated temperatures and to abrasion. The enamel should be melted and carefully heated until it is fluid enough to brush. The temperature should not exceed 375 F. When fluid it should be mopped on quickly, as it sets and hardens rapidly.

8 Bituminous Mastic. This is used chiefly for floors on account of the thickness of the layer which must be applied, but some mastics can be troweled on a vertical surface. Some mastics are applied cold. Others must be heated until fluid. The cold mastic consists of two compositions — the priming solution and the body coat or mastic. The primer is first brushed on. When the primer has dried to a tacky state, a thin layer — about $\frac{1}{32}$ in. — of the mastic is troweled on. When this has dried, successive $\frac{1}{32}$-in. coats of the mastic are applied until the required thickness has been built up. The mastic is similar to the primer but it is ground with sufficient asbestos and finely powdered siliceous material fillers to make a very thick, pasty, fibrous mass.

The hot mastics are somewhat similar to the mixtures used in sheet asphalt pavements, but contain more asphaltic binder so that when heated to fluid condition, they can be poured and troweled into place. They are satisfactory only when applied in layers of 1 in. or more in thickness. When ready to lay, the mixture usually consists of about 15 per cent asphaltic binders, 20 per cent finely powdered siliceous material, and the remainder sand graded up to ¼-in. maximum size.

9 Vitrified brick or tile. These are special burnt clay products which possess high resistance to attack by acids or alkalies. They must, of course, be laid in mortar which is also resistant against the substance to

which they are to be exposed. A waterproof membrane and a bed of mortar are usually placed between the brick or tile and concrete. Some of the acid-resistant cements are melted and poured in the joints. Only materials suitable for the conditions should be used, and the manufacturer's directions for installation must be followed. Silica brick and cement are not resistant to hydrofluoric acid and the hydroxides, but special brick and cement for these are available.

10 **Glass.** Glass may be cemented to the concrete, as recommended by glass manufacturers. Cement for fastening glass to concrete surface is provided by the glass manufacturer.

11 **Lead.** Lead may be cemented to the concrete with asphalted paint. Smaller lead sheets may be fused into a large, continuous sheet by "burning" them together.

12 **Sheets of synthetic resin, rubber, and synthetic rubber.** Thin sheets of synthetic resin, rubber or synthetic rubber resistant to many acids, alkalies, and other substances are available. These are cemented to the concrete with special adhesives.

Protection Against Brine

Many solutions, such as brines and salts, which have no chemical action on concrete may crystallize upon loss of water. It is especially important that concrete subject to alternate wetting and drying of such solutions be impervious. When the free water in the concrete is saturated with salts, the salts crystallize in the concrete near the surface in the process of drying, and this crystallization may exert sufficient pressure to cause surface scaling. Salt solutions corrode steel more rapidly than plain water. In structures which are to be subjected to frequent wetting and drying by these solutions, it is essential to provide impervious concrete and sufficient coverage over the steel, and it may be advisable to provide some surface coating such as sodium silicate, linseed oil or one of the varnishes, as an added protection.

Data Sheet—Concrete Floor Surface Treatments

(*continued on next page*)

Acids

Material	Effect on Concrete	Surface Treatment*
Acetic	Disintegrates slowly	5, 6, 7
Acid waters	Natural acid waters may erode surface mortar, but usually action then stops	1, 2, 3
Carbolic	Disintegrates slowly	1, 2, 3, 5
Carbonic	Disintegrates slowly	2, 3, 4
Humic	Depends on humus material, but may cause slow disintegration	1, 2, 3
Hydrochloric	Disintegrates	8, 9, 10, 11, 12
Hydrofluoric	Disintegrates	8, 9, 11, 12
Lactic	Disintegrates slowly	3, 4, 5
Muriatic	Disintegrates	8, 9, 10, 11, 12
Nitric	Disintegrates	8, 9, 10, 11, 12
Oxalic	None	None
Phosphoric	Attacks surface slowly	1, 2, 3
Sulphuric	Disintegrates	8, 9, 10, 11, 12
Sulphurous	Disintegrates	8, 9, 10, 11, 12
Tannic	Disintegrates slowly	1, 2, 3

Salts and Alkalies (Solutions)**

Material	Effect on Concrete	Surface Treatment*
Carbonates of Ammonia, Potassium, Sodium	None	None
Chlorides of Calcium, Potassium, Sodium, Strontium	None unless concrete is alternately wet and dry with the solution, when it is advisable to treat with	1, 3, 4
Chlorides of Ammonia, Copper, Iron, Magnesium, Mercury, Zinc	Disintegrates slowly	1, 3, 4
Fluorides	None except ammonium fluoride	3, 4, 5
Hydroxides of Ammonia, Calcium, Potassium, Sodium	None	None
Nitrates of Ammonia	Disintegrates	8, 9, 10, 11,
Nitrates of Calcium, Potassium, Sodium	None	None
Potassium Permanganate	None	None
Silicates	None	None
Sulphates of Ammonia	Disintegrates	6, 7, 8, 9

Salts and Alkalies (Continued)

Material	Effect on Concrete	Surface Treatment*
Sulphates of Aluminum, Calcium, Cobalt, Copper, Iron, Manganese, Nickel, Potassium, Sodium, Zinc	Disintegrates; however, concrete products cured in high pressure steam are highly resistant to sulphates	1, 3, 4

Petroleum Oils

Material	Effect on Concrete	Surface Treatment*
†Heavy oils below 35° Baumé	None	None
†Light oils above 35° Baumé	None—Require impervious concrete to prevent loss from penetration, and surface treatments are generally used	1, 2, 3, 5, 9
Benzine, Gasoline, Kerosene, Naphtha	None—Require impervious concrete to prevent loss from penetration, and surface treatments are generally used	1, 2, 3, 5, 9
High octane gasoline		12

Coal Tar Distillates

Material	Effect on Concrete	Surface Treatment*
Alizarin, Anthracene, Benzol, Cumol, Paraffin, Pitch, Toluol, Xylol	None	None
Creosote, Cresol, Phenol	Disintegrates slowly	1, 2, 5, 9

Fats and Fatty Acids (Animal)

Material	Effect on Concrete	Surface Treatment‡†
Fish oil	Most fish oils attack concrete slightly	1, 2, 3, 5, 9
Foot oil, Lard and lard oil, Tallow and tallow oil	Disintegrates surface slowly	1, 2, 3, 5, 9

*Treatments indicated provide sufficient protection in most cases but any of the other treatments numbered higher than highest shown often may be advisable.
**Dry materials generally have no effect.
†Many lubricating and other oils contain some vegetable oils. Concrete exposed to such oils should be protected as for vegetable oils.
‡Applied in thin coats the material quickly oxidizes and has no effect. Results indicated above are for constant exposure to the material in liquid form.
††Treatments indicated provide sufficient protection in most cases but any of the other treatments numbered higher than highest shown often may be advisable.

Data Sheet—Concrete Floor Surface Treatments

(*continued from preceding page*)

Vegetable Oils

Material	Effect on Concrete	Surface Treatment*
Cottonseed	No action if air is excluded. Slight disintegration if exposed to air	None 1, 2, 5, 9
Rosin	None	None
Almond, Castor, ‡China wood, Coconut, ‡Linseed, Olive, Peanut, Poppy seed, Rape seed, ‡Soybean, ‡Tung, Walnut	Disintegrates surface slowly	1, 2, 5, 9
Turpentine	None—Considerable penetration	1, 2, 5, 9

Miscellaneous

Material	Effect on Concrete	Surface Treatment††
Alcohol	None	None
Ammonia water (am. hydroxide)	None	None
Baking soda	None	None
Beer	Beer will cause no progressive disintegration of concrete, but in beer storage and fermenting tanks a special coating is used to guard against contamination of beer	Coatings
Bleaching solution	Usually no effect. Where subject to frequent wetting and drying with solution containing calcium chloride provide	1, 3, 4
Borax, boracic acid, boric acid	No effect	None
Brine (salt)	Usually no effect on impervious concrete. Where subject to frequent wetting and drying of brine provide	1, 3, 4
Buttermilk	Same as milk	3, 4, 5
Charged water	Same as carbonic acid—slow attack	1, 2, 3
Caustic soda	None	None
Cider	Disintegrates (see acetic acid)	5, 6, 7
Cinders	May cause some disintegration	1, 2, 3
Coal	Great majority of structures show no deterioration. Exceptional cases have been coal high in pyrites (sulphide of iron) and moisture showing some action but the rate is greatly retarded by deposit of an insoluble film. Action may be stopped by surface treatments	1, 2, 3
Corn syrup	Disintegrates slowly	1, 2, 3

Miscellaneous (Continued)

Material	Effect on Concrete	Surface Treatment*
Cyanide solutions	Disintegrate slowly	7, 8, 9, 10, 12
Electrolyte	Depends on liquid. For lead and zinc refining and chrome plating use	7, 8, 9, 10, 12
	Nickel and copper plating	None
Formalin	Aqueous solution of formaldehyde disintegrates concrete	5, 9, 10, 11, 12
Fruit juices	Most fruit juices have little if any effect as tartaric acid and citric acid do not appreciably affect concrete. Floors under raisin seeding machines have shown some effect, probably due to poor concrete	1, 2, 3
Glucose	Disintegrates slowly	1, 2, 3
Glycerine	Disintegrates slowly	1, 2, 3, 4, 5, 9
Honey	None	None
Lye	None	None
Milk	Sweet milk should have no effect, but if allowed to sour the lactic acid will attack	3, 4, 5
Molasses	Does not affect impervious, thoroughly cured concrete. Dark, partly refined molasses may attack concrete that is not thoroughly cured. Such concrete may be protected with	2, 5, 9
Niter	None	None
Sal ammoniac	Same as ammonium chloride—causes slow disintegration	1, 3, 4
Sal soda	None	None
Saltpeter	None	None
Sauerkraut	Little, if any, effect. Protect taste with	1, 2
Silage	Attacks concrete slowly	3, 4, 5
Sugar	Dry sugar has no effect on concrete that is thoroughly cured	None
	Sugar solutions attack concrete	1, 2, 3
Sulphite liquor	Attacks concrete slowly	1, 2, 3
Tanning liquor	Depends on liquid. Most of them have no effect. Tanneries using chromium report no effects. If liquor is acid, protect with	1, 2, 3
Trisodium phosphate	None	None
Vinegar	Disintegrates (see acetic acid)	5, 6, 7
Washing soda	None	None
Whey	The lactic acid will attack concrete	3, 4, 5
Wine	Many wine tanks with no surface coating have given good results but taste of first batch may be affected unless concrete has been given tartaric acid treatment. For fine wines the concrete has been treated with 2 or 3 applications of tartaric acid solution. (1 lb. tartaric acid in 3 pints water.) Sodium silicate is also effective. In a few cases tanks have been lined with glass tile.	
Wood pulp	None	None

National Defense Demands More TVA Power

TENNESSEE VALLEY AUTHORITY recently pointed out that power consumption of the atomic installations is really a significant part of the power demand on the TVA system. Perhaps the people in the TVA region do not generally realize that the last five years have seen a phenomenal increase in the demand for TVA power for national defense, TVA reported. It is a situation in which the best Hollywood adjectives truly apply.

TVA's statistical summary of the situation is as follows:

In 1950, federal defense agencies bought only 2 billion kwhr of TVA power; in 1955 TVA supplied 22 billion to federal defense plants. This is a 1000 per cent increase.

The atomic plants use considerably more power in a year than the hydro plants of the entire Tennessee River system can produce. It is this power load which is most responsible for the large steam plants TVA has had to build. The atomic plants obtain more power from TVA than is used in all of New England.

Oak Ridge alone requires a great deal more power than the industrial area of Detroit.

Federal defense plants, of which the atomic load is much the greater share, used 52 per cent of TVA's power output in the last fiscal year and the rate of use has increased since then.

WOULD YOU LIKE TEAR SHEETS?

Readers wanting tear sheets of any article appearing in this issue for their personal file may obtain them by indicating the item desired on one of the post cards appearing in this issue—Editors.

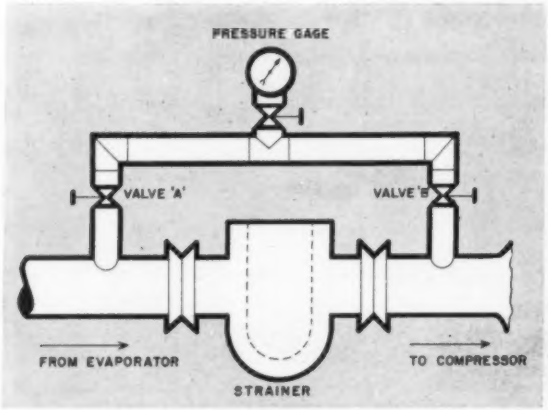


Fig. 1. Test arrangement for checking suction pressure loss. Compressor capacity depends on absolute suction pressure

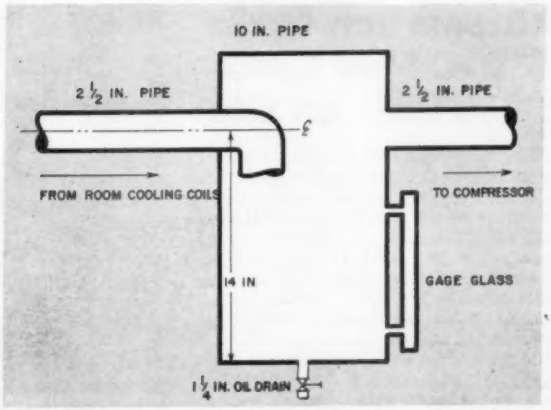


Fig. 2. Diagram of oil trap installation in suction line of compressor with large oil accumulations in cooling coils

Refrigerating Plant Problems

By C. T. BAKER*

SOME AMMONIA compressors have their scale traps located in the suction line external to the compressor assembly. In such cases the strainer is usually located near the suction inlet to the compressor.

These strainers are often made from very fine mesh material and the effective area of such strainers, even when free of foreign matter, is often not too liberal. Such strainers require more frequent cleaning than those having a greater effective area.

On more than one occasion the writer has traced loss in compressor capacity to partly stopped up suction strainers. In one plant having a total of four compressors, one was a horizontal twin cylinder double acting machine, each cylinder of which was protected with an individual strainer. When removed for examination, all strainers were found to have at least 75 per cent of the screen area heavily coated with pipe scale and other foreign materials.

Another plant having three large compressors was found to be operating with strainers largely plugged with pipe scale, litharge paste, etc.

In each plant the compressors had all operated for several years at reduced suction pressure and lowered capacity. The significance of this loss is reflected in the fact that the refrigerating capacity of a given compressor depends upon the weight of gas it will handle in a given length of time, and that the weight of the ammonia suction gas handled depends upon the efficiency of the compressor and upon the pressure at which the gas enters the compressor.

As the weight of the ammonia gas varies approximately as the absolute pressure, it is evident that the capacity of a given compressor varies with the absolute suction pressure.

To enable the plant engineers to make periodic checks to determine if there was a noticeable pressure loss in the suction strainers in the two plants investigated, a simple test connection was provided for making pressure loss tests. This scheme is shown in Fig. 1.

The simple test operation is as follows. First, connect pressure gage as shown; next, open valve A and note the pressure at the up-stream end of the suction strainer. Next, close valve A and open valve B and note the pressure on the down stream end of the strainer. The difference, if any, between the two readings will show the pressure loss through the strainer assembly.

So long as this loss remains small, less than 1 lb, it is not necessary to open a strainer for inspection.

Sometimes one of the materials causing strainers to plug up is a mixture of lubricating oil and foreign matter. There are still in service many coil evaporators that have not been provided with means for drawing off oil accumulations which means that any oil leaving such coils must be carried out with the suction gas. This may mean that considerable oil is carried along with the gas back to the compressor. If such oil is mixed with scale or other substances common to piping systems, such mixtures are very effective as inhibitors to free flow of gas through a strainer.

On one occasion a cold storage room containing several hundred lineal feet of 2 in. direct expansion cooling coils which had not been used for nearly two years, was to be placed back in service. Since no provision had been made for drawing off oil accumulations from these coils, it was thought that they may have collected a considerable amount of oil.

To offset possible trouble from this source, an oil trap, shown in Fig. 2 was installed in the suction line near the individual compressor that normally cooled the room in question.

Subsequent developments showed that there was a great deal of oil trapped in these coils. The oil, when drawn from the separator, was found to contain large quantities of finely divided particles of scale and muck, all of which could have caused strainer trouble.

Compressor Too Large

The refrigerating compressor in a meat processing plant was too large for the load. It handled the cooling demands of the chill and aging rooms.

During weekends, nights, and holidays, when no warm meat was placed in storage, the oversize compressor lowered the suction pressure far below that which would be normal for the service required.

The low evaporating pressure increased the temperature spread between the air entering the unit cooler and the temperature of the evaporating ammonia refrigerant. This action, of course, had a pronounced drying effect on the air being circulated. In time, this dehydrating action caused so much moisture loss in the product that it began to shrivel.

The plant owner was advised to install a suction pressure regulating valve on the gas outlet of the fan driven air cooling unit and reduce the speed of the compressor.

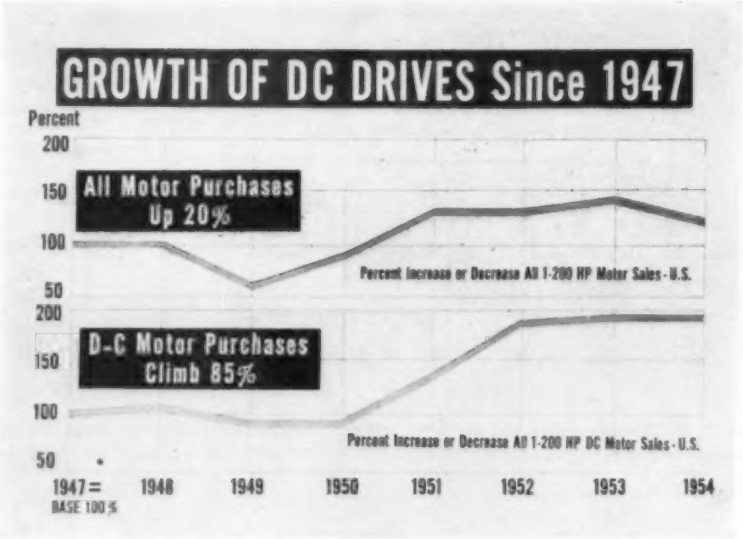
The back pressure valve was adjusted to hold an evaporating pressure of 40 lbs gauge regardless of the pressure on the down stream end of the valve. This corresponds to a temperature of 25.8 F. evaporating temperature and gave a heat head of 10 to 12 degrees between the room temperature and temperature of the evaporating liquid refrigerant. This cured the trouble.

*Consulting Engineer

Automation Gives D-C New Lease on Life

MANY PEOPLE feel that d-c motors are old-fashioned, expensive, and obsolete. Just how wrong is this view was emphasized last month when the General Electric Company announced a new line of motors and generators designed specifically to meet the needs of the growing number of automation applications in modern industry.

Direct current drives provide the flexibility of adjustable speed without which automation could never have reached its present degree of development, and they have certain desirable characteristics which cannot be obtained with any other kind of drive. The accompanying chart shows how the use of d-c drives has paralleled the growth of automation in modern industry.



As chart shows, d-c motor purchases increased 85 per cent from 1947 to 1954. Comparable increase for all motor types for same period was only 20 per cent

For automation applications motors need to respond quickly to control signals and to be able to start, stop and reverse very rapidly. To give the motors these characteristics they are designed with low armature inertia, reduced shunt field time constants, and with high transient commutating ability, so that in addition to having a very rapid response to control signals, they can also take heavy overloads for short periods.

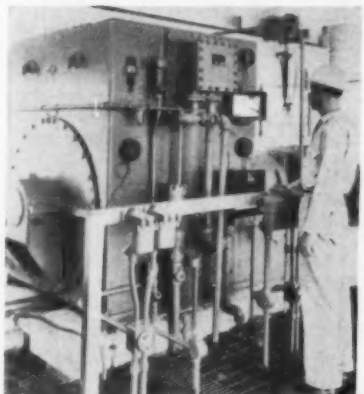
Another way in which automation applications affect motor design is in the matter of maintenance and accessibility. With the trend toward automation, plant operating costs are decreasing, but maintenance costs are increasing as equipment becomes more complex and more of it is used. Furthermore, failure of a single component can cause heavy losses by shutting down an entire line of interconnected production equipment. Thus motors to be suitable for work on an automatic production line need to be extremely reliable so that maintenance is reduced to a minimum, and they also need to be accessible, so that maintenance can be carried out efficiently and quickly and trouble can be located quickly in case they do break down.

These Inert-Gas-Filled Motors Give Maximum Explosion Protection

THREE 350 HP, totally enclosed, inert-gas-filled motors at the Baltimore Refinery of the Esso Standard Oil Company, have been put into operation driving hydrogen compressors. The motors were designed and built for maximum protection against explosion of hydrogen due to sparking.

Each of the motors is built with a practically gas-tight enclosure which is made as gas-tight as possible by the following precautions:

1. "Blind" holes are used where bolts enter the outside of the enclosure. (Bolt holes are drilled and tapped in the heavy steel frame, without going entirely through the metal.)
2. A machined "surface fit" where the bearing brackets attach to the motor housing eliminates need for gaskets.
3. Gas tight, continuous welds are used throughout during the fabrication.
4. Oil-pressure gas seals in the bearings make the bearings practically gas tight. The seals are virtually non-wearing and require no more attention than long life sleeve bearings.



An inert-gas-filled motor installation

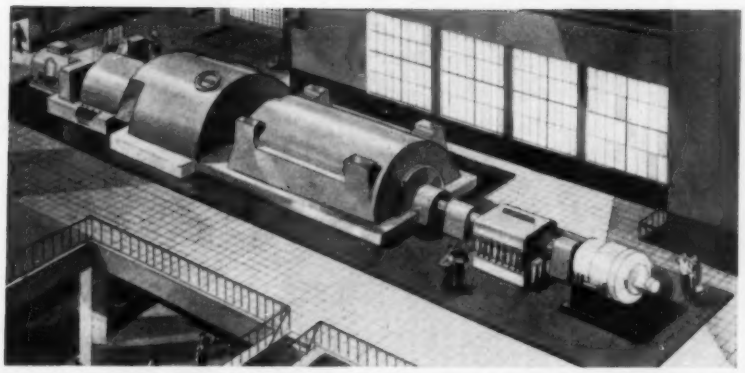
Inert gas is maintained inside the enclosure at a slight positive pressure so that the slight leakage of gas through the motor is of inert gas going out instead of explosive gas going in.

The motors are cooled by circulation of the inert gas. Gas-to-water coolers are mounted near the top of the enclosure.

The sleeve bearings are flood lubricated (a combination of forced-feed and oil ring methods). With oil rings furnished, the motor could operate indefinitely after failure of the pressure oil supply, without damage to bearings.

A high degree of protection for these motors is provided by special instruments and controls which permit the operator to check the functioning of the motor at a glance. Standard safety features include: (1) Inert gas pressure and temperature gages, and relays with alarms and/or shutdown contacts; (2) Rotating-type indicators for oil feed to bearings; (3) oil level sight gages on oil reservoir and bearing housing; (4) purging valves for start-up.

Optional features on these motors include: (1) Water cooler with double-tube construction; (2) Liquid level detector switch; (3) Bearing temperature relays; (4) Water flow indicator; (5) Special explosion-proof potheads, condulets, etc. The motors, built by Electric Machinery Mfg. Company, Minneapolis, drive Ingersoll-Rand Reciprocating Compressors.



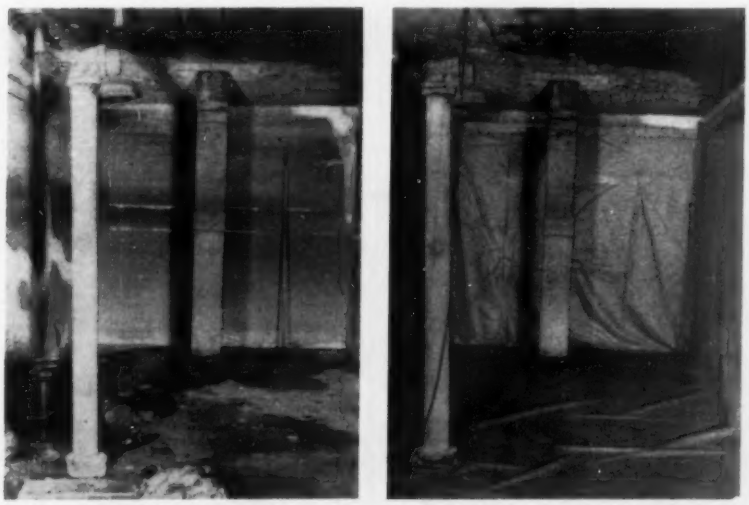
How the main turbine will drive 6330-gpm boiler feed pump through fluid coupling

Main Turbine Drives World's Largest BF Pump

WORLD'S LARGEST BOILER feed pump is being built by Byron Jackson for the Consolidated Edison Co. of New York, Inc. According to BJ engineers, this pump will be at least twice as large as any boiler feed pump now in existence in this country. This new pump — rated at 12,000 hp — will deliver 6330 gpm at a total dynamic head of 6400 ft, or about 2700 psi at a speed of 3510 rpm.

The unit will consist of a cylindrical outer barrel and cover enclosing a horizontally-split inner volute case. The double volute design, together with back-to-back mounting of the impellers, is intended to provide for quick, uniform heating and reduces to a minimum both axial and radial thrust.

For this pump, power company engineers are employing an altogether new concept of drive, utilizing the most efficient power plant driver: the main steam turbine generator. Power is transmitted through an American Blower Corp. fluid drive coupling for variable speed operation to meet all load conditions.



Above: After the cracks were ground and filled. Right: After lining with Krene

Water Seepage Eliminated With Plastic Lining

WATER SEEPAGE of two to three gpm was virtually eliminated at Logan City Diesel Plant, Utah, by lining a 5,000-gal concrete diesel-electric plant cooling tank with Krene plastic sheeting. Here hot water from diesel engines is mixed with cold, then returned to cool the engines. Sharp difference in temperatures inside and outside tank caused severe cracking in walls and floor. When engines were shut down (midnight to 6 a.m.) water level dropped so low, circulating pumps lost their prime. After lining was installed, water level dropped an average of only ½ in. in same time.

OVEC Speeds Atomic Power Installations

THE LARGEST electric power plant in Ohio — Kyger Creek Plant on the Ohio River at Cheshire — was in full operation December 1953, more than three months ahead of schedule.

The Ohio Valley Electric Corp. announced that the fifth and last of Kyger Creek's 215,000-kilowatt steam turbine-generators has been placed in operation. Some construction work and final details, however, remain to be completed. At 1,075,000 kw, the station is the largest in the Buckeye State and the second largest power plant ever built anywhere by private enterprise.

Kyger Creek and Clifty Creek Plant, its sister station located at Madison, Ind., also on the Ohio River, were built by OVEC for the single purpose of supplying the full and tremendous electric power requirements of the U. S. Atomic Energy Commission's giant new Portsmouth (Ohio) Project.

Five 215,000-kw units also are in operation today at Clifty Creek. Operation of the sixth, and final unit there, will give Clifty Creek a total capacity of 1,290,000 kw, making it the world's largest private power plant.

Probably the most outstanding aspect of the construction job at both plants has been the speed with which it is being carried out. OVEC was organized only three years ago. Ground was broken at both plant sites in December 1952. The first generating unit at each plant was placed in commercial operation in February of last year. The final unit — the 11th in all — is scheduled for early 1956.

This will mean that OVEC will have placed 2,365,000 kw of electric power capacity in operation in 12 months' time — the installation of more power in so short a period than ever before accomplished in the history of the electric utility industry.

OVEC is a corporate organization sponsored by 15 private electric utilities of the Ohio Valley region. These companies are: Appalachian Electric Power Co., The Cincinnati Gas & Electric Co., Columbus and Southern Ohio Electric Co., The Dayton Power and Light Co., Indiana & Michigan Electric Co., Kentucky Utilities Co., Louisville Gas and Electric Co., Monongahela Power Co., Ohio Edison Co., Ohio Power Co., Pennsylvania Power Co., The Potomac Edison Co., Southern Indiana Gas and Electric Co., The Toledo Edison Co. and West Penn Power Co. Appalachian, Ohio Power and Indiana & Michigan are subsidiaries of American Gas and Electric Co.; Monongahela, Potomac and West Penn Power are subsidiaries of The West Penn Electric Co., and Pennsylvania Power is a subsidiary of Ohio Edison.

Power Engineering handbook

Let's Talk Combustion

Part III

By R. R. TAGGS

IN THE FIRST two parts of this discussion, the theoretical and practical air requirements for proper combustion and some of the devices for maintaining that supply were presented. The controls were of the flow meter type, however, and only served to relate the air supply as a function of the steam produced. This is a useful concept, and is in wide use, but it is not so precise as instruments which monitor the products of combustion for signs of excess or insufficient combustion air. Some of these devices not only indicate their findings, but initiate a corrective action. CO_2 devices will be discussed this month, and the next issue describes O_2 meters.

CO_2 Recorders

Combustion guides of the qualitative type or gas analyzers actually measure the percentages of certain components in the exit gases and provide a direct check on efficiency. Their accuracy is not affected by variations in steam pressure or temperature, feedwater temperature or regulation, air temperature or the condition of the boiler heat-absorbing surfaces. There are three common methods of measuring carbon dioxide, the CO_2 recorder being the least expensive and most commonly used instrument of this type. One of these methods employs chemical absorption similar to the hand orsat, another compares thermal conductivity of the gases with that of air, and a third measures specific gravity.

Thermal conductivity type CO_2 recorders operate on the principle that every gas has a somewhat different rate of heat transfer. Fig. 5 shows the effect of passing several different gas samples through a thermal conductivity type of instrument that produces a deflection of 100 for a 100 per cent CO_2 sample. The vertical scale shows relative deflection obtained with various gas samples, while the horizontal gives the percentage of each gas contained in nitrogen. Nitrogen was used as the base or zero reference line, but air would be practically the same. As a rule, in combustion gases CO_2, nitrogen, and some oxygen would be the principal gases present. Small quantities of other gases such as argon and SO_2 would have little or no effect on the reading since they produce a deflection in the same direction as CO_2 but of slightly different magnitude. Sizable quantities would introduce an error but the amounts normally encountered could be calibrated out since there will be a definite relationship between their percentages throughout the range of the instrument.

Hydrogen will produce a substantial error in the reading because it has a very pronounced deflection in the opposite direction from that of CO_2. In some cases this may prove to be advantageous as hydrogen may begin to show up when a deficiency of air exists, and even a small amount will reduce the CO_2 reading.

A sharp drop in the record when operating at high CO_2 values would indicate the presence of hydrogen. Figure 6 shows the cell block assembly used in one thermal conductivity CO_2

FIG. 5 RELATIVE DEFLECTION [100%CO_2=100]

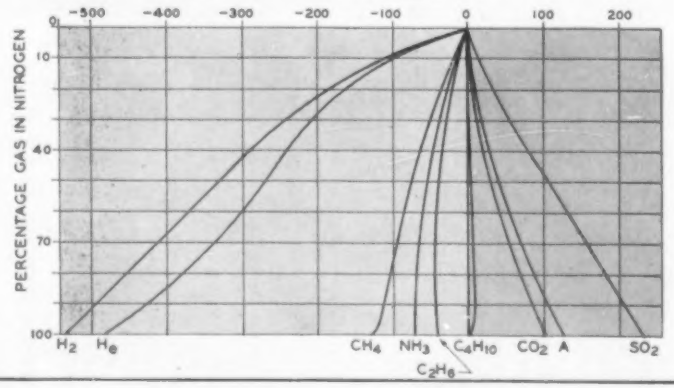
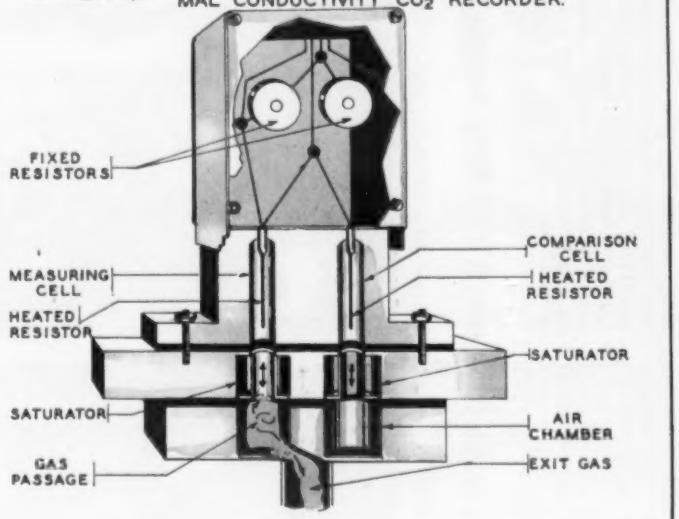


FIG. 6 — CELL BLOCK ASSEMBLY OF A THERMAL CONDUCTIVITY CO_2 RECORDER.



fold along this line—outside edges toward you

In water conditioning...

the tough jobs

go to

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

W. H. & L. D. BETZ, Philadelphia, Pa.

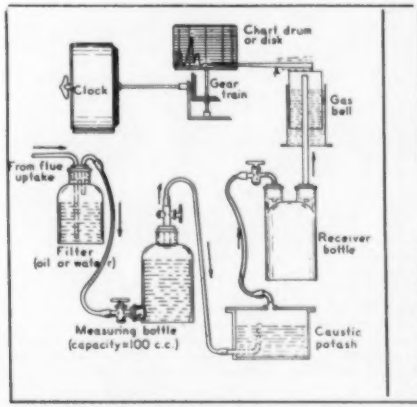


FIG. 7 —The essentials of a CO_2 recorder. The Orsat type recorder is constructed on this principle

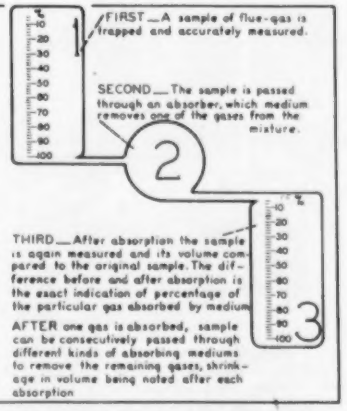

FIRST—A sample of flue-gas is trapped and accurately measured.
SECOND—The sample is passed through an absorber, which medium removes one of the gases from the mixture.
THIRD—After absorption the sample is again measured and its volume compared to the original sample. The difference before and after absorption is the exact indication of percentage of the particular gas absorbed by medium
AFTER one gas is absorbed, sample can be consecutively passed through different kinds of absorbing mediums to remove the remaining gases, shrinkage in volume being noted after each absorption

FIG. 8 —The Orsat principle of gas analysis by volumetric measurement and and selective chemical absorption.

recorder. There are two identical cells, each containing a heated resistor forming part of a resistance bridge circuit (similar to the Wheatstone Bridge). The measuring cell receives gas samples while the isolated comparison cell contains air, both being saturated to provide an analysis on a standard basis. The heated resistors are small in diameter and have very little mass so there is very little heat inertia present and temperature changes are rapid.

As the gases conduct heat away from the heated resistor in the left hand cell, the temperature naturally decreases, the amount of change being dependent on the thermal conductivity of the gas in the cell. Meanwhile, air occupies the right-hand cell at all times and keeps the resistor on this side at a fixed temperature and, therefore, at a fixed resistance. Since these two fixed resistors form legs of a resistance bridge, the difference between the two elements can be determined — thereby showing the thermal conductivity of the gas in the cell.

Automatic Orsat CO_2 Recorder

The automatic Orsat type of CO_2 analyzer is one that does not require an engineer or chemist to operate it. Unlike the conventional Orsat, the automatic unit requires no valve manipulation, no leveling, no burette readings. Two relatively simple movements of a rod is all that is necessary for an analysis — the result indicated on a large, legible scale.

It was developed to meet an insistent demand for a gas analyzer that anyone could use, that would withstand transporting about and yet be sufficiently accurate for all practical test purposes.

Two models are made — one for CO_2 only, another for both CO_2 and O_2. The CO_2 unit adheres strictly to the principle of volumetric measurement and chemical absorption. The sample of flue gas is aspirated from a point in the flue to the measuring chamber by means of an aspirator bulb. During this operation a rod is withdrawn. When sample is secured, rod is pushed down, causing the analyzing body to tilt into position.

As the analyzing body is tilted, mercury flows from a reservoir into measuring chamber, displacing the sample and forcing it into an absorption chamber which is filled with metal wool saturated with Cardisorber (a CO_2 absorbing chemical). Here the CO_2 in the gas sample is absorbed, causing a vacuum through shrinkage in volume. This vacuum or suction is transmitted through metallic bellows to a large pointer which indicates the CO_2 percentage on the scale located on the face of the instrument. The same dial

fold along this line — outside edges toward you

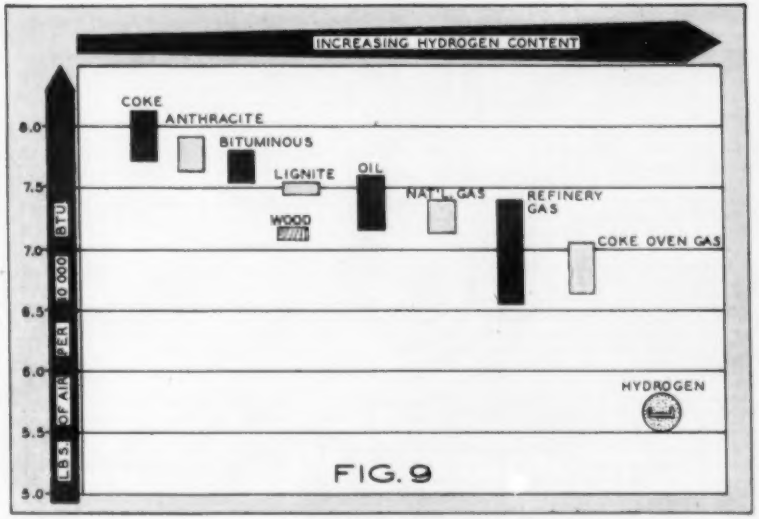


FIG. 9

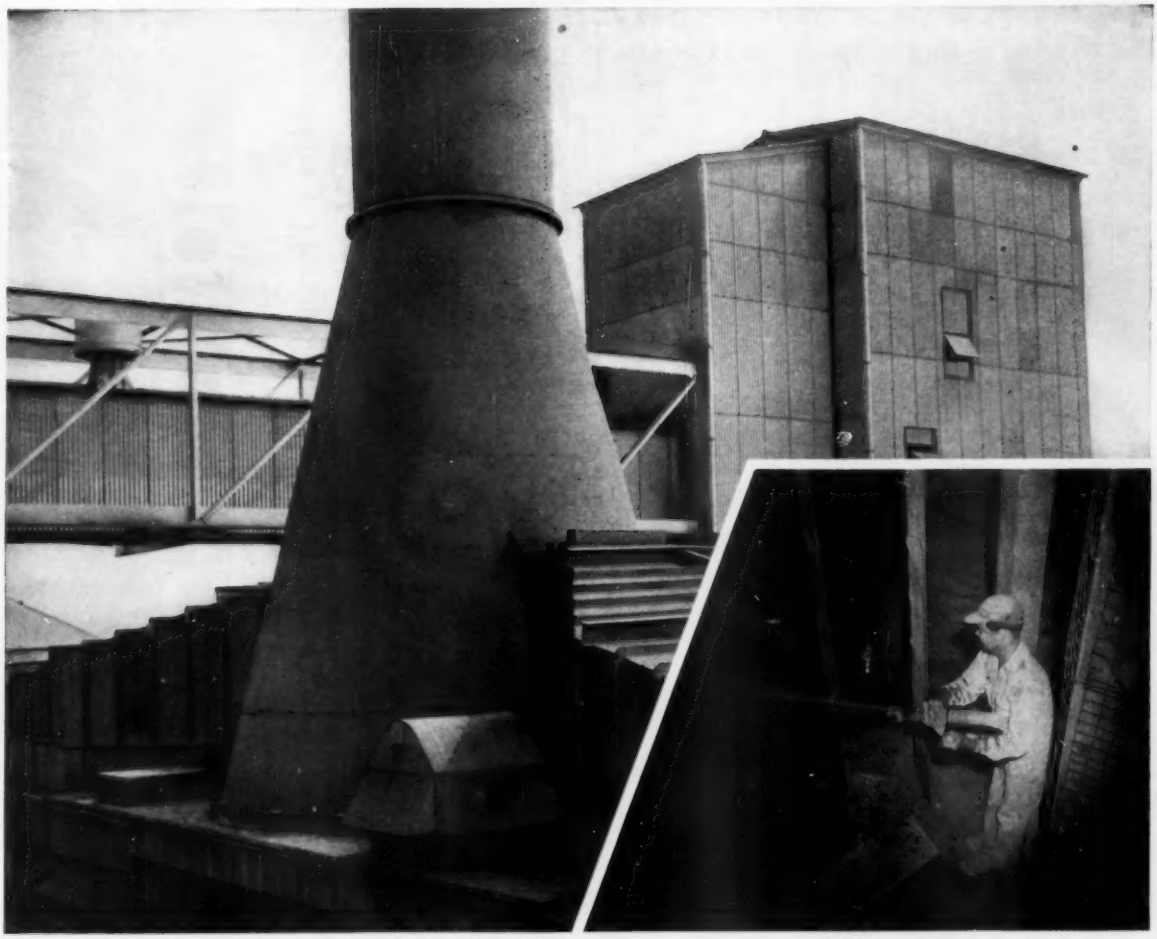
has a scale graduated to show draft measurement in inches of water.

Multiple Fuel Firing

Refineries, steel mills, chemical plants, and a host of other industries have for many years burned a combination of fuels consisting largely of by-products from their own various processes. In recent years, the trend toward burning several fuels has spread to all industries. Special rates on gas at specified times, lack of coal at other times, and the desirability of burning liquid or gaseous fuels under certain load or process conditions have all influenced this change. Therefore, when considering combustion problems, some thought will have to be given to multiple fuel firing.

The pounds of air required to liberate 10,000 Btu with various types of fuels are shown on the vertical scale of Fig. 8. The horizontal scale is not calibrated as there is no direct relationship between air requirement and hydrogen content. In general, however, as the hydrogen content of the fuel increases the amount of air required for 10,000 Btu is reduced. These values are all theoretical and do not consider the question of excess air. Actually, the difference in the amount of air required by coke and coke-oven gas is more than that shown on this chart while greater percentages of excess air would be needed with any of the solid fuels than with gas or oil. Consequently, no fixed relationship between air flow and heat produced can be assumed for all fuels.

Since the air flow-steam flow meter operates on this principle, either the instrument would have to be recalibrated for various conditions of firing or some factor would have to be applied. In some plants, the operators are instructed to keep the pens (stylii) at a fixed distance apart when using an instrument calibrated for coal firing or gas firing. This, of course, changes the relationship between fuel and air and may be correct at any given point. However, a percentage change is actually required, and if a constant difference is maintained between the two pen positions the ratio will not be correct over the full range of operation. Since oxygen percentage remains nearly constant for a given percentage of excess air with wide variations in fuel composition, the oxygen recorder gives a direct check on combustion conditions independent of hydrogen-carbon ratio and relationship of air flow and heat release.



STEEL STACK at Ohio Edison Co., plant, Shadyside, Ohio.

STACK LINING being gunited with Lumnite cement.

Protect steel stacks from corrosion, abrasion with linings of Lumnite* concrete

Efficiency goes *up* and operating costs come *down* when you line your steel stacks with long-lasting concrete linings made with Lumnite* cement.

Quickly "shot" in place, these smooth, jointless linings improve drafts . . . protect stacks from attack of corrosive gases . . . protect breechings against the abrasive action of high-velocity fly ash. If repairs are ever needed, they can be made quickly and easily because concrete made with Lumnite cement reaches service strength within 24 hours.

Stack linings are just one of the many profitable uses you'll find for concrete made with Lumnite calcium-aluminate cement. Use it for baffles, arches, door linings — in fact, wherever heat, corrosion or abrasion are problems.

Keep a supply of Lumnite cement or prepared Lumnite-base castables on hand for emergency needs. Packaged castable mixes containing Lumnite cement and selected aggregates assure the right concretes for a wide variety of applications. All you do is add water, mix and place. Castables are made and distributed by leading manufacturers of refractories. For more information on special industrial concretes made with Lumnite cement, write:

UNIVERSAL ATLAS CEMENT COMPANY

UNITED STATES STEEL CORPORATION SUBSIDIARY

100 PARK AVENUE, NEW YORK 17, N. Y.

Albany · Birmingham · Boston · Chicago · Dayton · Kansas City · Milwaukee
Minneapolis · New York · Philadelphia · Pittsburgh · St. Louis · Waco

*"LUMNITE" is the registered trade-mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.

BCR-L-120

Atlas® Lumnite Cement

FOR INDUSTRIAL CONCRETES

REFRACTORY • INSULATING • OVERNIGHT • CORROSION-RESISTANT

United States Steel Hour—Televised on alternate Wednesdays—See your local newspaper for time and station.

For more data circle 551 on Post Card

Power Engineering handbook

Selecting Thrust Bearings for Large Vertical AC Motors

IT IS ALWAYS important to have the right bearings on electric motors, but vertical a-c motors in the larger sizes deserve an extra measure of attention to this matter. The reasons for this are simple, but important: Large investments are literally riding on the thrust bearings; public welfare (in the case of water supply, sewage and flood control pumps) frequently depends on the reliability of vertical pump drives; the larger motors frequently have no standby power unit; and finally, motor manufacturers often authoritatively disagree with one another on bearing recommendations.

When the experts disagree, it is more or less up to the customer engineer who, it is assumed, will know the most about his specific requirements. With this in mind study the following information originally presented by one of the motor manufacturers (Electric Machinery Mfg. Co.) in tabular form.

Ball Bearings

Characteristics of the deep groove or angular contact ball-type thrust bearings are as follows:

Thrust Capacity: — Low to moderate. Can be stacked in duplex or triplex mountings, providing thrust for angular contact type up to 20,000 lb, depending on speed. Capacity of deep groove type is somewhat lower.

Speeds: — Moderate; up to 1800 rpm for grease lubricated bearings, depending on size and duty, but higher where oil lubrication is provided.

Lubrication: — Usually grease lubricated. Can be oil lubricated at higher speeds to help dissipate heat and avoid frequent greasing. Occasionally, low-speed bearings are oil-lubricated with bearing partially or completely submerged in oil.

Cooling: — By oil when that lubricant is used.

Advantages: — Grease lubricated bearing not as sensitive to mishandling at assembly (or during maintenance) as the oil lubricated type and operates better in dirty or dusty surroundings.

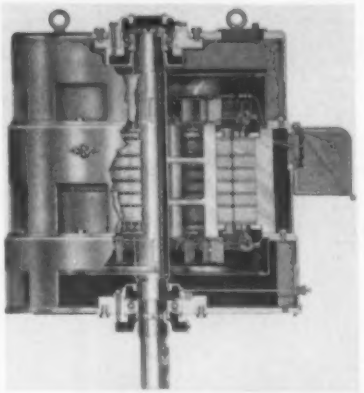


Fig. 1. Motor with angular contact ball bearings

Lightly loaded normally, they are capable of handling short-duration overloads of several times design capacity. Deep groove bearings can take upward thrust. This is accomplished with angular contact bearings by back-to-back arrangement so that one bearing handles upward thrusts.

Limitations: — Not self-aligning, so the bearing housings, caps, etc. require close tolerances.

Maintenance: — Requires small amount of grease at intervals prescribed by manufacturer. Provision is made for removal of expended grease without costly disassembly.

Roller Bearings

Characteristics of the spherical or tapered roller thrust bearings are:

Thrust Capacity: — Relatively high — up to 100,000 lb, depending on speed.

Speeds: — Moderate — up to 1200 rpm, depending on duty.

Lubrication: — Oil, because of size and complexity of bearing. Generally it is partly submerged in the lubricant.

Cooling: — Rotation circulates cool oil through the bearing. On larger sizes and high speeds, bearing can be cooled by submerging cooling water coils in oil reservoir.

Advantages: — Available in larger sizes than most other bearings, with inherently greater capacity of rollers over balls. Spherical roller bearings are self-aligning, resulting in equal distribution of the load.

Limitations: — Relatively larger than ball bearings, and do not take upward thrust.

Maintenance: — Lubrication oil must be kept at proper level and changed at specified intervals.

Kingsbury Bearings

Characteristics of the Kingsbury type thrust bearing are as follows:

Thrust Capacity: — Very high — up to hundreds of tons, depending on speed.

Speeds: — Low, medium or high.

Lubrication: — Bearing submerged in oil. Rotating collar separated from stationary babbited shoes by film of oil so that there are no rubbing surfaces.

Cooling: — Viscosity pumping effect of thrust collar circulates oil within the housing and over cooling coils (if they are provided).

Advantages: — Self-aligning through action of leveling plates, providing equal distribution of load. Accessible for maintenance if required. Available for high speed, high thrust applications. Indefinitely long life if properly maintained.

Limitations: — Relatively high first cost. Often requires cooling water supply. Large physical size. Greater friction loss than anti-friction bearings.

Maintenance: — Lubrication oil must be kept at proper level, changed at prescribed intervals.

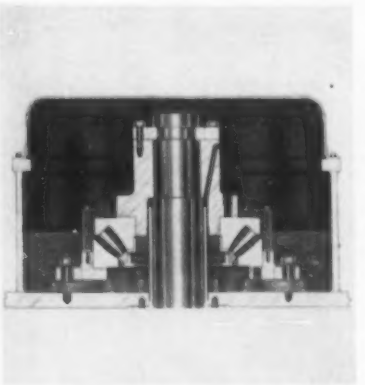


Fig. 2. The spherical roller type thrust bearing

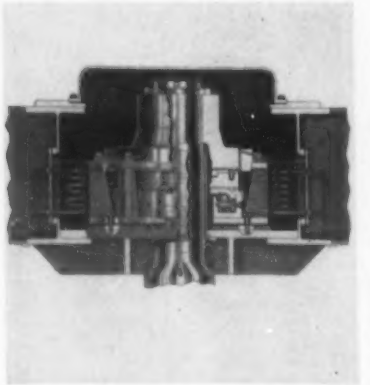
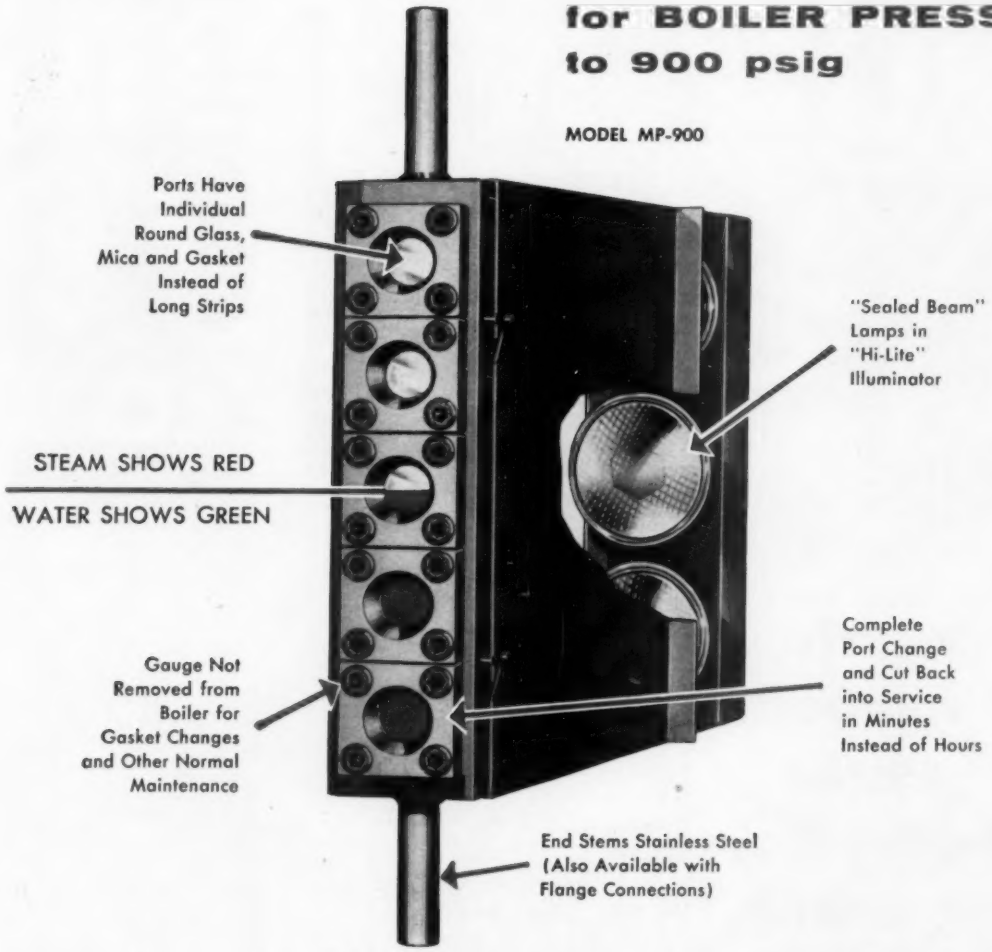


Fig. 3. Long-lived Kingsbury type thrust bearing

Announcing ...DIAMOND "Multi-Port" Bi-Color Gauge

for BOILER PRESSURES to 900 psig

MODEL MP-900


Ports Have Individual Round Glass, Mica and Gasket Instead of Long Strips
"Sealed Beam" Lamps in "Hi-Lite" Illuminator
STEAM SHOWS RED
WATER SHOWS GREEN
Gauge Not Removed from Boiler for Gasket Changes and Other Normal Maintenance
Complete Port Change and Cut Back into Service in Minutes Instead of Hours
End Stems Stainless Steel (Also Available with Flange Connections)

The individual round ports each having its own round glass, round mica and round gasket (instead of the conventional long strips) means less stress and strain . . . resulting in greatly reduced maintenance. When replacement is required, it is usually only one port . . . which can be changed in a very few minutes . . . and without removing the gauge from the boiler.

The Diamond Bi-Color feature is another important advantage of the MP-900 Multi-Port . . . steam always shows red and water always shows green. There can be no question of the water level.

Recommended for both new and old boilers up to 900 psig, the MP-900 Multi-Port will give you a new standard of gauge operation. Use the coupon below for additional information.

7358

DIAMOND POWER SPECIALTY CORP. AB
LANCASTER, OHIO

Please send me without obligation a copy of new Bulletin No. 2044 explaining the advantages of the Diamond MP-900 "MULTI-PORT" Bi-Color Gauge for all boiler operating pressures up to 900 psig.

NAME_____

COMPANY_____

ADDRESS_____

DIAMOND POWER SPECIALTY CORP.

LANCASTER, OHIO

Diamond Specialty Limited • Windsor, Ontario

For more data circle 552 on Post Card

Power Engineering handbook

Unique Solder Pots Speed Work

HERE ARE TWO ideas that can help speed electrical work involving dip-soldered connections:

Small wires can be connected quickly and effectively with a self-heating solder pot made from an electric soldering iron. To make this convenient tool, choose an iron with a nickel steel tip (for long life) and drill a blind hole into that part of the tip extending beyond the heating element. The size of this hole is dependent on the tip size and the type work to be undertaken.

When the iron is brought up to temperature, solder is melted into the hole where it is periodically replenished. If work continues very long at a time it would be prudent to clean the hole periodically to avoid the ills of oxidized solder; the drill used to make the hole will do the reaming job effectively.

To solder, twist the small wires together, dip them in flux, and then dip them into the molten solder. Solder run-over or splashes can be caught in a guard made of 1/32-in. steel and attached to the shaft of the iron with a hose clamp.

An alternate means of soldering wires, including those of considerably larger size, would be to insert the tip of an electric soldering iron into a standard pot and melt solder on it until the required puddle forms. A shield to guard against burns should be formed of asbestos blanketing. Another method, perhaps more desirable than the first, would be to form both the support and shield for the iron from standard magnesia pipe insulation. This comes in half-cylinder sections which can be arranged like a 30/60° triangle set on its shortest side; the vertical piece would support the iron and the diagonal piece would shield it. The iron should be wire-brushed periodically.

Remember: Fuse Clips Are Radiators

WHILE IT IS generally recognized that corroded or poorly fitting fuse clips make poor electrical conductors, little attention is given the fact that these clips are also lacking in their ability to dissipate the heat generated within the fuse in normal operation. Any fuse, no matter what size, generates a given amount of heat for a given steady current. If this heat were allowed to build up without proper dissipation, the fuse would fail long before reaching its rated electrical capacity. In normal operation, this heat travels along the fusible element, into the end ferrules, and from there to the fuse clips for dissipation to the atmosphere.

When corrosion or an improper fit reduces the contact area between the clip and ferrule, or interposes a poor conductor of heat between them, the operating temperature of the fuse will be considerably higher than it should be. This, of course, leads to fuse failure at a lower current than was intended for the use.

The increased thermal resistance attending a poor contact between fuse clip and ferrule usually means an equally poor electrical contact. The current in the circuit will not be greatly affected by this small extra load, so nearly full current will be generating extra heat at that point in accordance with the I^2R rule.

Since heat is being *generated* by the heat dissipator, it will obviously not encourage heat flow *from* the fuse strip. Hence, the failure current of the fuse will be correspondingly lower.

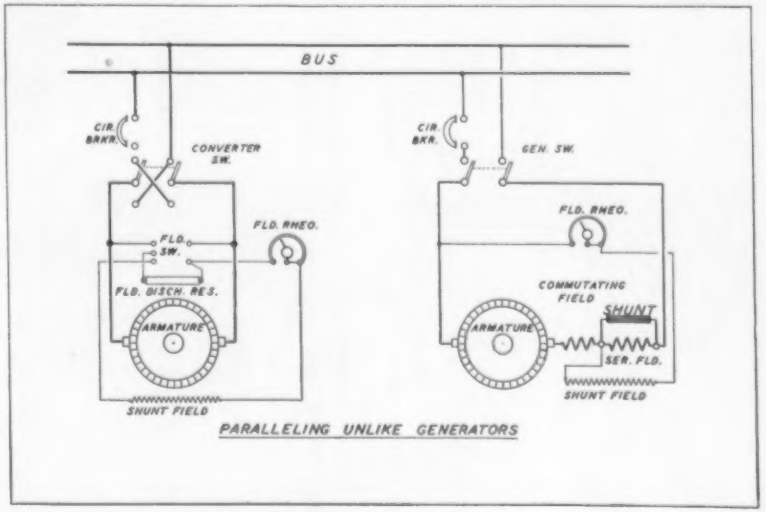
Paralleling Unlike D-C Machines

By GEORGE METRY

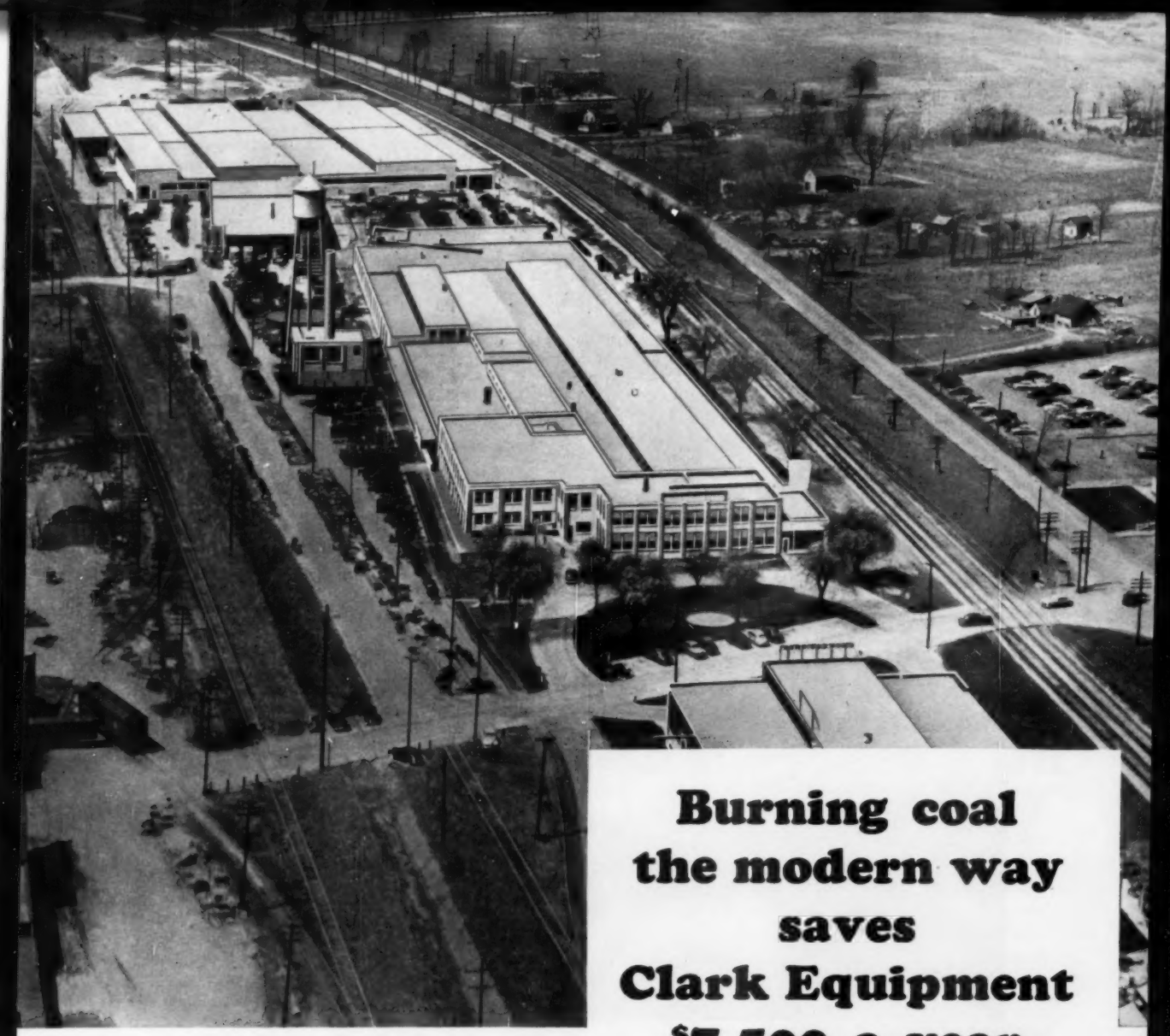
IT IS common practice in industry and power plants to parallel two like d-c generators such as two engine-driven machines or two m-g sets. They can be made to divide the load between them according to their rating if they are properly compounded and are provided with good speed regulation.

However, operating a shunt-wound rotary converter in parallel with an a-c motor-driven, compound-wound, d-c generator, as illustrated in the diagram, requires a little experimenting. The writer recently had such a problem.

Since the converter was a shunt-wound machine its voltage decreased inversely with the load. For the compound-wound generator to operate in parallel with this converter, its voltage also had to drop directly with the load. To obtain this drop we fabricated a copper-ribbon shunt which we connected in parallel with the generator's series field winding as shown. The correct length of this ribbon-shunt was found by trial and error. After the proper length was finally ascertained for dividing the load, the two sets operated amicably together, and have done so since without interruption.



PARALLELING UNLIKE GENERATORS



Burning coal the modern way saves Clark Equipment $7,500 a year

Consult an engineering firm

Designing and building hundreds of heating and power installations a year, qualified engineering firms can bring you the latest knowledge of fuel costs and equipment. If you are planning the construction of new heating or power facilities—or the remodeling of an existing installation—one of these concerns will work closely with your own engineering department to effect substantial savings not only in efficiency but in fuel economy over the years.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use • No smoke or dust problems when coal is burned with modern equipment • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

Expanding production facilities at Clark Equipment Co., Battle Creek, Mich., created a need for more steam within the plant. In the face of rising overall costs, Clark engineers decided to meet this demand by modernizing the firm's power system.

Today, two watertube boilers utilizing spreader stokers have replaced three firetube boilers, underfeed fired. Stokers are fed by screw conveyor and controls are fully automatic. As a result of these and other aspects of its modernization program, Clark's boiler plant has now increased plant efficiency, supplying reliable, low-cost steam for all purposes—at a savings of $7,500 a year.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION
Southern Building • Washington 5, D.C.

For more data circle 553 on Post Card

NEW ENGINEERING BOOKS

Thermodynamics Refresher for Professional Engineer's License, by John D. Constance. New second edition; formerly in combined text Refresher Notes. Size 8½ by 11 in., paper binding; 100 pages. Published by John D. Constance 625 Hudson Terrace, Cliffside Park, N. J. Price $3.50, including book postage within U. S. A. and T. H.

As noted above, the material contained in this book originally appeared in a combined text as Refresher Notes by the author, intended for a study aid for candidates preparing for a professional engineer's license, both professional engineers and engineers in training, for the civil service examinations and for power engineers' licenses.

The material was originally used by the author in a refresher course in New York City sponsored by ASME. Much new material has been added in this book to help candidates in all states. Illustrative problems have been carefully selected and screened and the subject matter treated as concisely and practically as possible.

In all cases, the practical aspects of each problem are reviewed, the necessary practical formulas are given, and solutions are worked out mathematically.

In preparing for the examination, a certain technique must be attained so that the candidate will feel at home in the examination room. This Thermodynamics Refresher is intended to do this by screening out superfluous material and presenting comprehensive collections of selected past examination problems and their solution.

The text of the refresher covers the following phases of the subject: outline of basic chemistry and physics; gases and vapor behavior; air compressors, liquids and vapors; orifice and nozzle flow of gases and vapors; fuels and combustion, steam power; internal combustion engines; refrigeration; heat transfer; air conditioning; many charts, tables, monographs.

The refresher is designed to be particularly helpful to those taking examinations for Parts II (Basic Engineering Sciences) and III (Mechanical and Chemical Engineering) of the New York Examination and the Junior (EIT) and Senior (P.E.) Examinations of all other States.

Practice problems are grouped and placed at the end and a problem index has been added to facilities reference. A new section on air conditioning has been added and that on heat transfer expanded.

The author is at present on the teaching staff of the Kings County Chapter of the New York State Society of Professional Engineers and also is supervising instructor in charge of refresher courses at the M. W. Kellogg Co. in New York City. He is author of several articles on professional engineer's examination in POWER ENGINEERING and is very active in providing management and engineering personnel with guidance procedure for licensing.

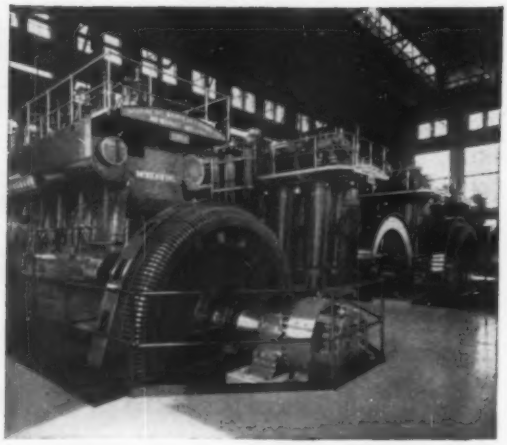
All engineers who must take the professional license examination will obtain a great deal of practical help from this book and we heartily recommend it for that purpose.

★ ★ ★

Glass Reinforced Plastics, edited by Phillip Morgan, M.A.; 248 pages; size 6 in. by 9¾ in., cloth cover. Published by the Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. Price $10.00.

As plastics find their way into industrial use in greater numbers and with more diverse properties than ever before dreamed, it is very helpful to have a modern book dealing with plastic properties and applications on one's bookshelf. This is such a book, especially on the subjects of glass-reinforced plastics. It is primarily a production book, not closely related to the operation of the power plant. ***continued on page 114***

WORN Cylinders?
SCORED Cylinders?



PORUS - KROME
Good for the Life of your Engines

is the answer.

- **Reclaim the bores of worn or scored power cylinder liners with wear resistant PORUS-KROME.**
- **Write for detailed information on this economical service for power plants.**

Dept. B-1, VAN DER HORST CORP., OLEAN, N. Y.

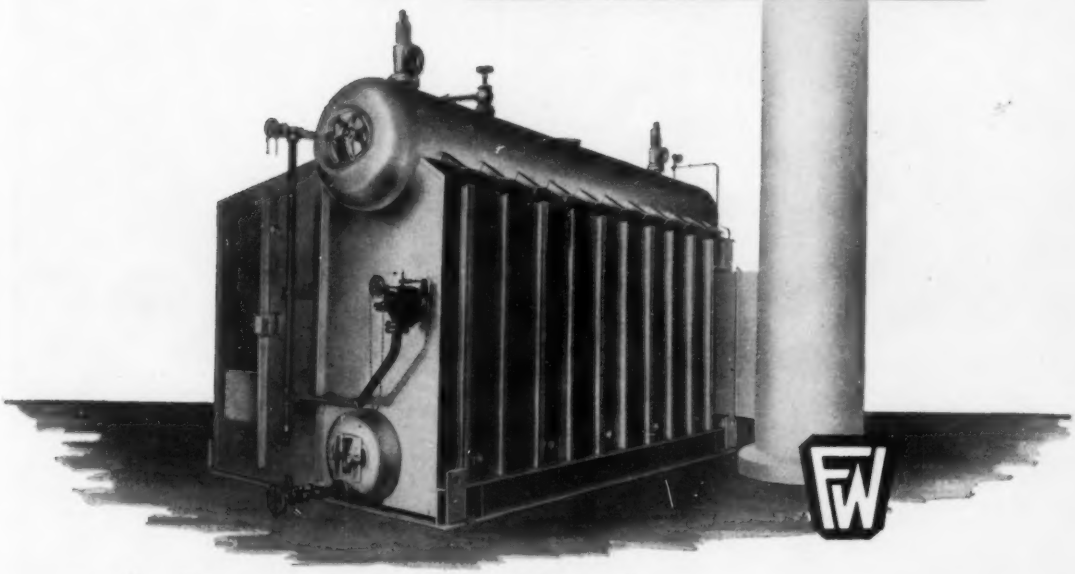
OLEAN, NEW YORK — TERRELL, TEXAS

VAN DER HORST

HILVERSUM, HOLLAND — LOS ANGELES, CALIFORNIA*

*SparTan Engineering

CUT STEAM-PLANT INSTALLATION AND MAINTENANCE COSTS

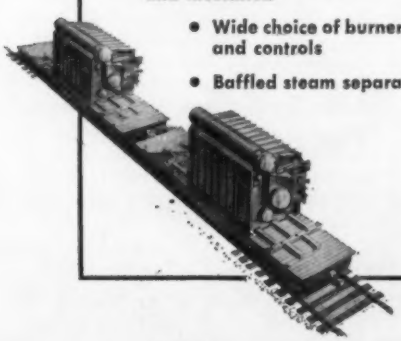


. . . with the NEW Foster Wheeler

PACKAGED STEAM GENERATOR

CONSTRUCTION FEATURES

- 36″ steam drum and 24″ water drum
- Staggered boiler tube arrangements
- Closely spaced waterwall tubes
- Water cooled target wall
- No headers—Low circulation loss
- Light, highly efficient refractory and insulation
- Wide choice of burners and controls
- Baffled steam separator



HERE IS a compact, space-saving steam generator that is completely factory assembled and shipped to you ready to set on a simple, low-cost foundation—ready for your fuel, steam and electric connections. There is only one outlet to the stack, and this has a simple, flanged connection as shown above. Extremely compact design permits access to boiler rooms through average building openings.

Low refractory maintenance is assured by the use of closely-spaced waterwall tubes and water-cooled target wall. The boiler interior is easily accessible for cleaning through a large access door in the rear furnace wall, and dusting ports are provided along the boiler bank side at intervals of not more than 42″. Soot blowers can be furnished as original equipment or installed later.

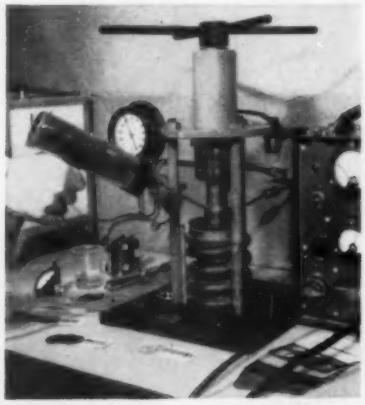
Available in capacities from 10,000 to 50,000 lb/hr, the *new* FW Packaged Steam Generator represents the last word in modern steam plant design. For complete details, send for Bulletin PG-55-3. *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

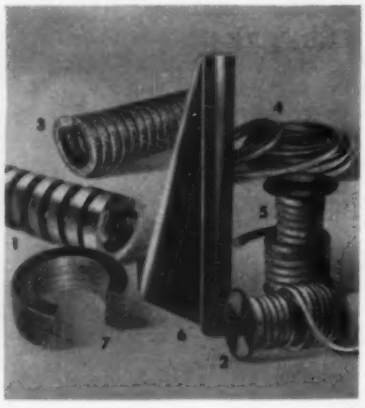
For more data circle 554 on Post Card

R/M's Big 7 Packing Types give you better results with lower inventory



The chances are excellent you will be able to meet all of the packing requirements of your plant with just 3 or 4 of R/M's Big 7 Packing Types. Because of their custom-built construction, you can set up a schedule of preventive rather than corrective maintenance.

Before being offered for sale, R/M's Big 7 Packing Types are run through rigid quality control tests. The leak detection test pictured above is just one of a great many different kinds to assure your getting the benefits of R/M's high manufacturing standards.



Call in your R/M distributor Ask him to show you specifically how you can lower your inventory, cut maintenance and downtime, simplify ordering, speed deliveries. All R/M packings for maintenance purposes are sold only through authorized R/M distributors.

Type 1, for pumps, valves; **Type 2,** for high temperature valve stems, expansion joints; **Type 3,** for high speed rotary air compressors; **Type 4,** for corrosives, acids, viscous materials; **Type 5,** "Teflon"* for chemicals; **Type 6,** gasket materials; **Type 7,** for hydraulic and pneumatic equipment.

*Du Pont trademark

R/M's BIG 7 PACKING TYPES MEET 95% OF ALL PACKING NEEDS

R/M **BIG 7 PACKINGS**
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, PASSAIC, N. J.
MECHANICAL PACKINGS AND GASKET MATERIALS

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Crawfordsville, Ind.; Neenah, Wis. Peterborough, Ontario, Canada.

RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Laundry Pads and Covers • Bowling Balls

For more data circle 590 on Post Card

Engineering Books

continued from page 112

One thing that the book teaches is that one no longer speaks of "plastics," but must prefix this term with a more specific identification. The field of plastics has grown so rapidly and in such diverse directions that the term plastics alone is no more identifying than the term "metal." The book is definitely a source of ideas on ways and means of applying modern plastics and fibre-glass-reinforced plastics to structural and electrical trouble spots.

We cannot recommend the book as essential reading for the power engineer, but we can recommend it as a very complete treatment on a subject becoming more important each day.

* * *

Elementary Theory of Nuclear Shell Structure, by Maria Goeppert Mayer and J. Hans D. Jensen; first edition 269 pages — 6¼ by 9¼ in.; cloth. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y., 1955. Price $7.75.

In this book the two research scientists who have been most responsible for the development of the theory of nuclear shell structure bring together, for the first time, all the pertinent processes and data into one simple and concise work. By analyzing a wealth of information in the light of the nuclear shell theory, they introduce order and understanding into many nuclear phenomena.

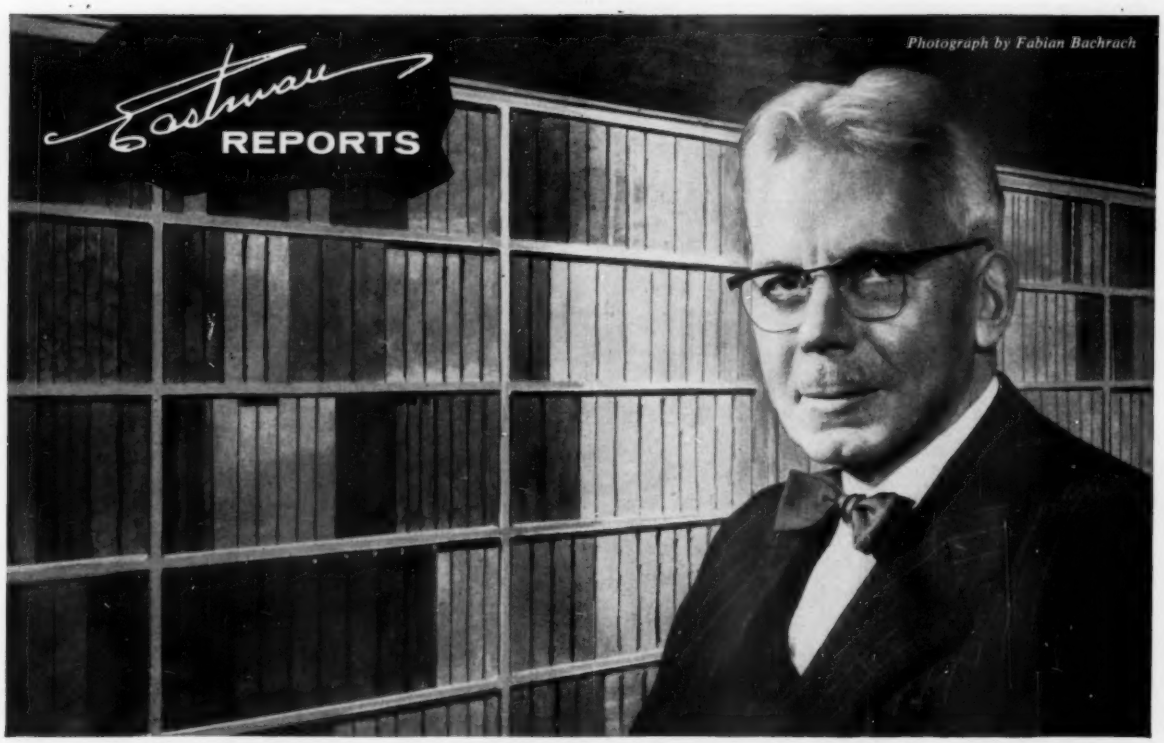
In the title "*Elementary* Theory of Nuclear Shell Structure", the word "elementary" is meant in its colloquial sense in that only simple methods and concepts of theoretical physics are employed. Naturally, this is not a book for the layman, yet it is capable of being understood by any engineer who has kept up, to some extent, with what has been going on in the field of nuclear physics during recent years.

The authors discuss and systematize such significant topics as nuclear spins and magnetic moments, quadrupole moments, beta decay and isomeric transitions, among others. An outstanding feature of the book is its extensive tables and graphs of nuclear data assembled in such a way that the important correlations are made as clear as possible. Physicists and nuclear chemists should welcome this useful correlation of theoretical material. In addition, physical chemists unfamiliar with nuclear physics, will find this book a clear and stimulating introduction to the field.

* * *

The Shell Theory of the Nucleus by Eugene Feenberg; first edition, 211 pages — 7 by 10 in.; paper cover. Published by the Princeton University Press, Princeton, N. J., 1955. Price $4.00.

The understanding of nuclear shell structure has developed in three overlapping



Eastman's confidential Editorial Research Reports to publishers prove that readers find advertising in Business Publications as interesting as editorial material. The full Eastman release on this subject is available to you on request.

"70% of Advertisement Reading in Business Publications is intentional—not accidental"

says **ROY EASTMAN** of the Eastman Research Organization

"Why shouldn't it be," Mr. Eastman continues, "since Business Publications advertise the very things by which readers make their livings?"

"A year and a half ago, we injected into all of our confidential readership surveys a penetrating inquiry as to *how* the advertising was read.

"The overall results of a year's inquiry on this subject (32 surveys for 18 publications) show that the average exposure to advertising is *70% intentional,* only 30% accidental.

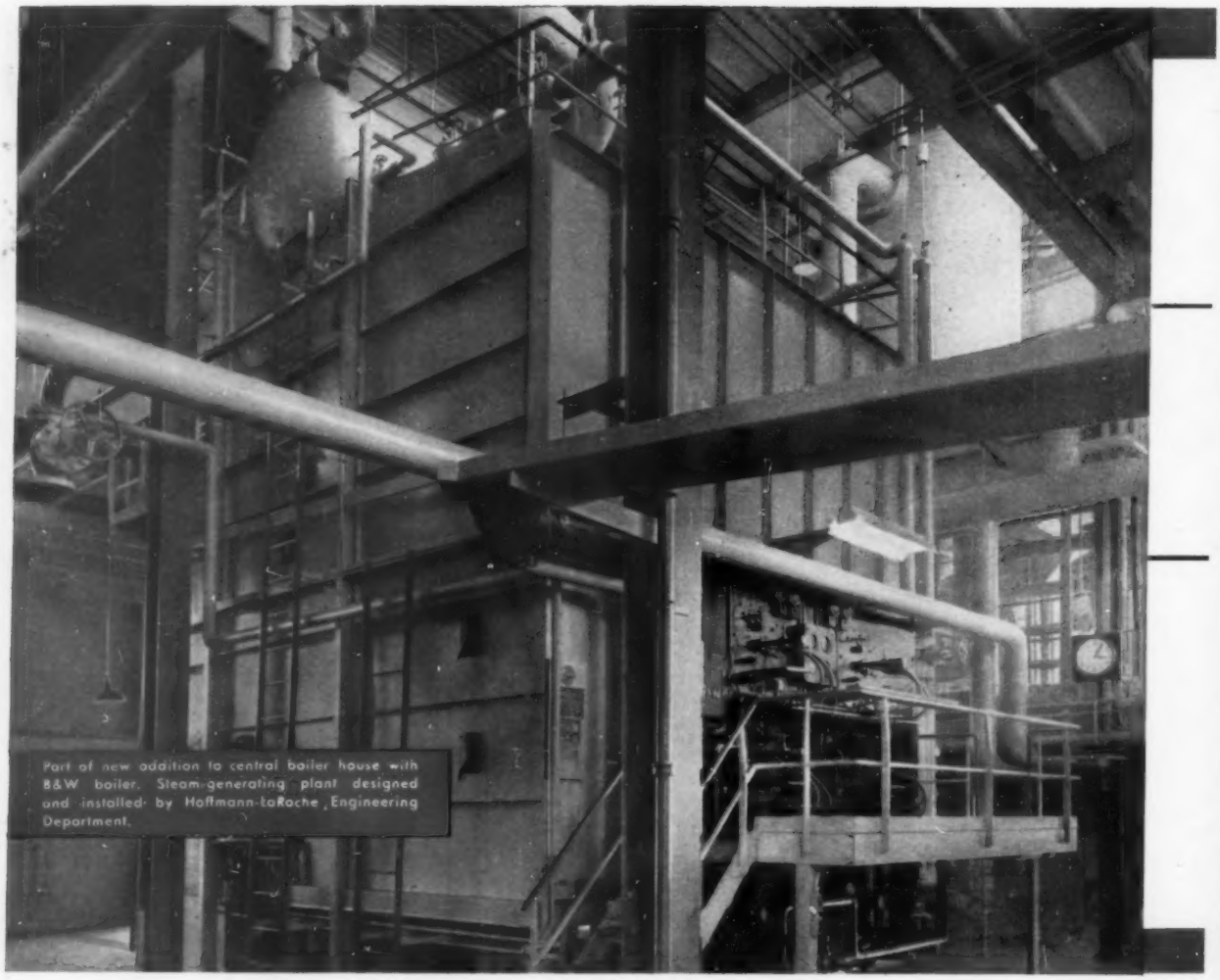
"Moreover, 94% of the readers of these publications, on the average, reported that they gave conscious attention to the advertising."

Advertisements in Business Publications reach an audience that's interested in your message . . . an audience that wants to read what you have to say.

NATIONAL BUSINESS PUBLICATIONS, INC. *1413 K Street, N. W., Washington 5, D. C. • STerling 3-7535*

The national association of publishers of 173 technical, professional, scientific, industrial, merchandising and marketing magazines, having a combined circulation of 4,098,937 . . . audited by either the Audit Bureau of Circulations or Business Publications Audit of Circulation, Inc. . . . serving and promoting the Business Press of America . . . bringing thousands of pages of specialized know-how and advertising to the men who make decisions in the businesses, industries, sciences and professions...pin-pointing the market of your choice.

Write for a list of the NPB publications and the "Here's How" booklet, "How Well Will We Have to Sell Tomorrow?", written by Ralston B. Reid, Advertising & Sales Promotion Manager of the Apparatus Sales Division, General Electric Company.



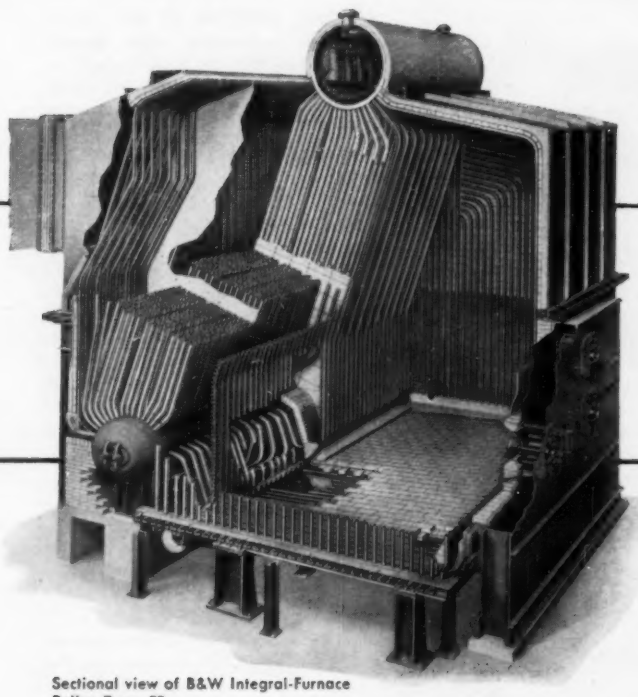
Part of new addition to central boiler house with B&W boiler. Steam-generating plant designed and installed by Hoffmann-LaRoche Engineering Department.

B&W FP BOILER HELPS Hoffmann-La Roche SOLVE SPACE AND STEAM PROBLEMS

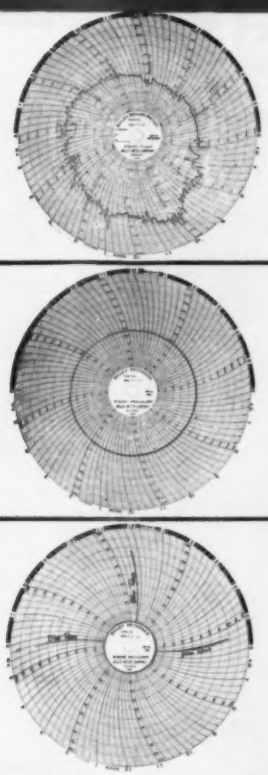
Spotless housekeeping, noticeable throughout Hoffmann-LaRoche's pharmaceutical plant, extends even into the new addition to the central boiler plant at Roche Park in Nutley, New Jersey.

A new B&W Integral-Furnace Boiler replaces four older, smaller and less efficient boilers, now on standby in another boiler room. This centralization of steam generation permits the company to more surely plan the use of that valuable space for expanding production facilities. The new boiler is oil-fired and has a design capacity of 75,000 lb. of steam per hr. The unit has a completely water-cooled furnace that provides durability and eliminates maintenance common to furnaces having considerable exposed refractory.

Choice of this B&W Integral-Furnace Boiler, as part of Hoffmann-LaRoche's continuing modernization program, was the result of careful weighing of all factors involved in the heating and processing operations. The program required additional dependable steam on tap in sufficient quantities at all times. Then, too, wide load swings have to be handled smoothly and economically. The B&W Boiler does this under complete auto-



Sectional view of B&W Integral-Furnace Boiler Type FP.



Steam flow, pressure, and smoke charts indicate handling of variable loads at constant pressure with a clean stack.

matic control, providing peak efficiency over the load range. An indication of the quick response and flexibility of the boiler in handling the load swings is indicated by the charts.

Like so many other companies of all kinds, where steam is required – for processing, heating, hot water, air conditioning – Hoffmann-LaRoche has selected an efficient B&W Boiler that precisely meets its needs for reliable, economical steam, and is backed by a policy of reputable service that assures complete satisfaction. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

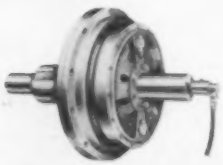
BABCOCK & WILCOX

BOILER DIVISION

G-770

For more data circle 556 on Post Card

DODGE PRODUCTS
you should know



AIR-GRIP CLUTCHES

CHAIN COUPLINGS

SEALED-LIFE V-BELTS

DODGE BULLETINS YOU SHOULD HAVE

- Air-Grip Clutches. Technical data, sizes and selection tables. Bulletin A634
- Chain Couplings, Taper-Lock Sprockets and Dodge Roller Chains. Technical data and selection methods. Bulletin A644
- Sealed-Life V-Belts. Construction details and complete data on sizes, pitch lengths and outside lengths. Bulletin A606

Write for your copies.

DODGE MANUFACTURING CORPORATION
6400 Union Street • Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

For more data circle 357 on Post Card

Engineering Books

continued from page 114

stages under the pressure of rapidly accumulating experimental information on the properties of nuclear states. In the first state problems of stability and abundance were emphasized. The second stage began with the explicit formulation of systematic shell models, and the application of the models to interpret spins and parities, magnetic dipole and electric quadrupole moments, isomerism and beta decay over the whole range of nuclear species.

A third stage is already in evidence, based on the application and further development of powerful mathematical techniques to problems of nuclear spectroscopy. The author has tried in this book to supply a guide to the developments of the second stage for readers who are familiar with the elements of nuclear physics and quantum theory. Ideas and results belonging to the first and third stages are discussed briefly in the first and last chapters.

This is not a book for beginners or for those who are not familiar with the basic ideas of nuclear physics and quantum theory.

* * *

A Glossary of Terms in Nuclear Science and Technology. First Edition, 190 pages — 5¼ by 8½ in; paper cover. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York, N. Y., 1955. Price $5.00.

This is a much needed book. The field of nuclear physics and the application of nuclear energy has been developing so fast in recent years that even those who are very active in the field have had difficulty in keeping up with the many and very new scientific terms that have come into use. A dictionary or glossary of such terms is, therefore, necessary.

As early as 1947, several of the scientific and technical societies were preparing glossaries of terms used in fields of nuclear energy. They, however, became aware of the desirability of better coordination of effort among the various active groups, and early in 1948 several of these societies approached the National Research Council and suggested that steps be taken to encourage better coordination. Following this suggestion, the National Research Council called a conference in June of 1948, and a plan was drafted by which existing efforts could be coordinated and, if necessary, supplemented.

The result of all this work is this very excellent book. It is more than a mere dictionary because in many instances the descriptions go into considerable technical detail. Engineers working in the field of nuclear power will particularly welcome this book since it gives them an easy reference for all sorts of technical terms, which may not be found in the usual scientific dictionary.

POWER ENGINEERING HANDBOOK REPRINTS

SECOND SECTION of the POWER ENGINEERING HANDBOOK, April through September 1955, is now being reprinted. These reprints will be available about April 1 at 35 cents a copy. The Gas Turbine Primer, October, November and December 1955, has already been reprinted and is available at 15 cents a copy.

When ordering, kindly enclose cash, check or money order.

BONUS:—Readers who order a reprint of the second Handbook section, April to September 1955, plus the Gas Turbine Primer, for a total of 50 cents, will receive FREE a reprint of the first section of the Handbook, October 1954 through March 1955, as long as the first section supply lasts.

The Lineman's Handbook, Third Edition, by E. B. Kurtz. Size 8¼ by 6 in.; 735 pages and 1000 illustrations, tables, diagrams, charts; cloth. Published by McGraw-Hill Book Company, Inc., 330 W. 42nd St., New York 36, N. Y. Price $10.00.

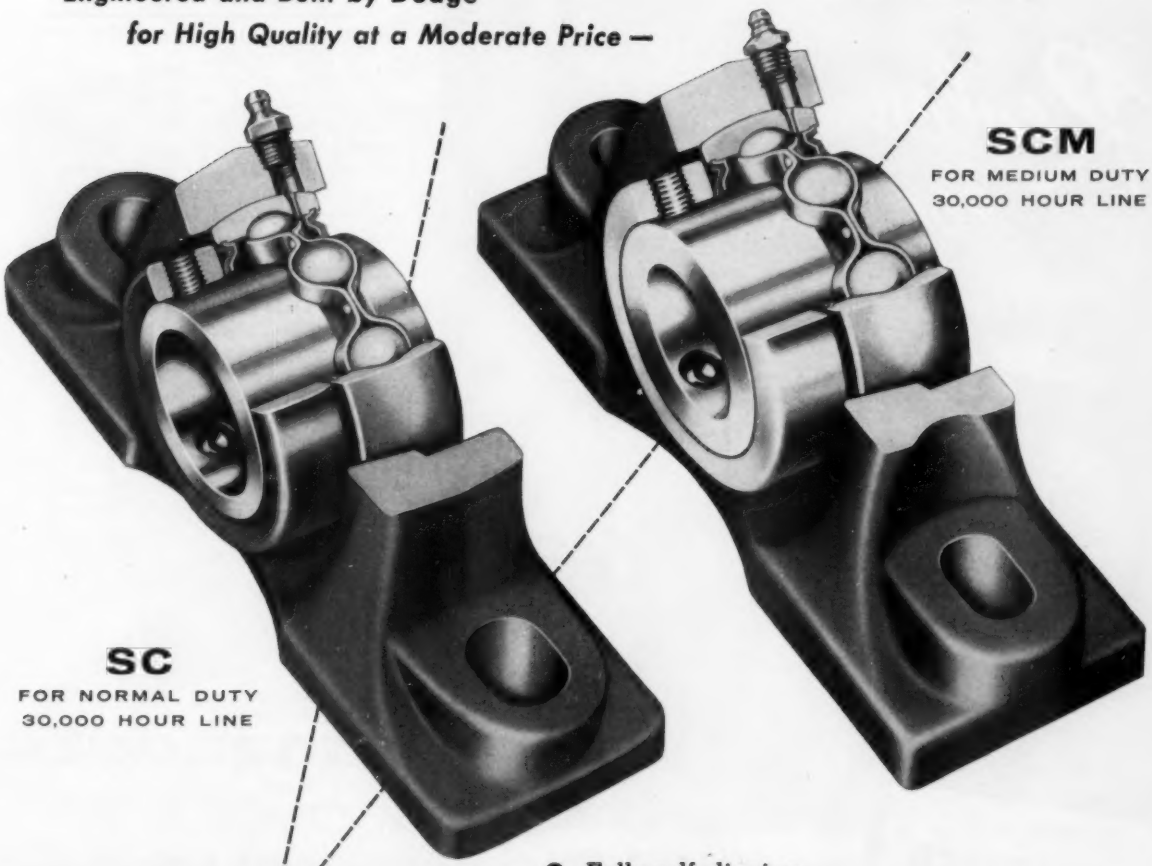
This handbook has been written expressly for the apprentice, the lineman, the foreman, the supervisor and other employees of line departments. It is intended primarily to be used as a home study book by the apprentice lineman, or the lineman, to supplement his daily experience at work.

The whole subject is covered in great detail and a special effort has been made to present all discussions clearly and in simple language; in fact, a knowledge of the English language is all that is required to understand the book. As in former editions a large number of illustrations showing various steps in construction and maintenance are given to help the reader; there are almost 1,000 illustrations appearing in the handbook. Nearly all the distribution and transmission-line erection views were taken within the last year especially for use in this edition. They, therefore, portray the latest practices in use today by some of the foremost electric utility companies in this country.

In this completely revised third edition there are many major additions and revisions that have brought the book completely up to date. These additions cover tower line erection, live line maintenance, rural lines, pole climbing, use of rubber protective goods, rope, knots, and slices, gear signals for line work, ground and pole top resuscitation methods and electrical formulas and calculations. The book covers the whole subject thoroughly with a wealth of practical illustrations from fundamentals of electricity and description of line materials and equipment to the installing of transformers and lightning arrestors.

Emphasis has been placed on the National Electrical Safety Code. The important re-

Engineered and Built by Dodge
for High Quality at a Moderate Price —



SCM
FOR MEDIUM DUTY
30,000 HOUR LINE

SC
FOR NORMAL DUTY
30,000 HOUR LINE

The Seal *Won't Blow!*

- Fully self-aligning.
- Rugged one-piece housing.
- Fully assembled and pre-lubricated at the factory.
- Sealed both on and off the shaft.
- Metallic backed synthetic rubber seals keep lubricant in, dust and dirt out. Engineered to stay put—*the seal won't blow!*
- Pillow block and flange cartridge types.
- Available from distributor stocks—SC in shaft sizes from 3/4" to 2-7/16"; SCM from 1-7/16" to 3-7/16".
- Write for bulletin complete with tabular data, engineering drawings, dimensions, weights, and radial load ratings.

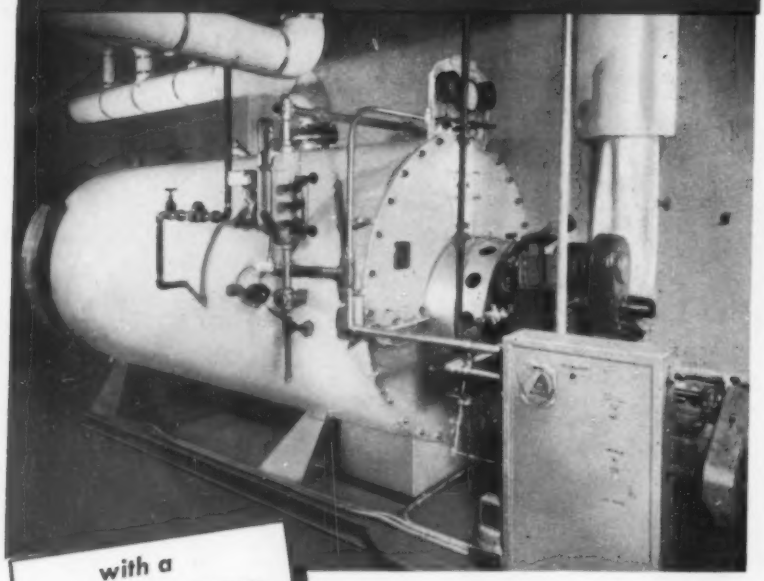
Call the Transmissioneer, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified telephone directory, or write us.

DODGE MANUFACTURING CORPORATION
6400 Union Street, Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

For more data circle 558 on Post Card

Revlon answers its own $64,000 Question



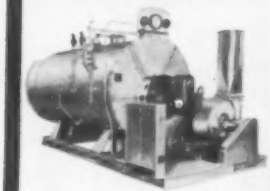
with a PREFERRED Unit Steam Generator

CASE HISTORY #5925

Revlon Reports

Cleaning—Once a year
Maintenance—Negligible
Stack Temperature—310°F. at full rating
CO_2—13 per cent
Fuel—Heavy oil (#6)
Operation—Fully Automatic
Remarks—"Amazed with its high efficiency and economy. Unit requires little or no attention. Preferred Utilities is to be congratulated for the competent unit they are producing."

This is one of a great many cases where the better quality built into Preferred Unit Steam Generators has helped their users find the most dependable and economic solution to their steam production problems. Let Bulletin 2000 prove how they can help you.



For new boiler rooms or for added steam capacity—your BEST bet is a Preferred Unit Steam Generator—BEST of all "packaged" boilers in design, construction and operating economy. Built in 19 sizes from 20 to 600 B.H.P. 15 to 250 p.s.i., for oil, gas or combination fuels; factory fire-tested before shipment. Get Bulletin 2000.

PREFERRED UTILITIES MANUFACTURING CORP.

1860 Broadway, New York 23, N. Y.
Department PE

For more data circle 539 on Post Card

Engineering Books

continued from page 118

quirements of the code are reprinted and incorporated in the text where corresponding topics are discussed. This has been done to help the lineman become acquainted with the minimum construction requirements to insure safety to the public and to the lineman.

Both the apprentice and the experienced lineman will find much in this book to help his understanding of construction and maintenance procedures and safe working practices. Section titles are listed below.

- Elementary electrical principles
- Distribution circuits
- Line materials and equipment
- Fundamentals of line design
- Locating and staking line
- Unloading, erecting, setting and poles
- Mounting crossarms, pins and insulators
- Joining, stringing and sagging conductors
- Installing transformer and lightning arrestors
- Patrolling and inspecting lines
- Testing
- Pole climbing
- Rubber protective equipment
- Ropes, knots and splices
- Tree trimming
- Signals for line work
- Resuscitation methods
- Accident-prevention and first aid courses for lineman
- Lineman's arithmetic and electric foreman's calculations

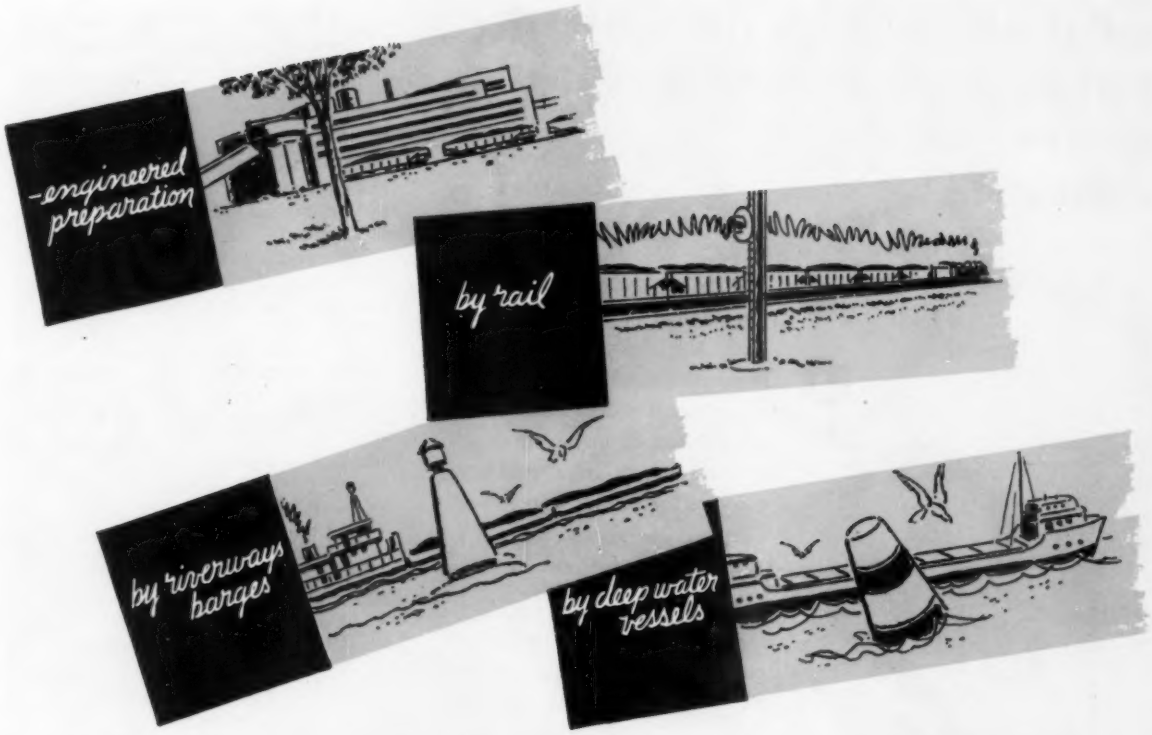
★ ★ ★

National Fire Codes, Vol. IV, Extinguishing Equipment 1955. Size 8¾ by 6 in.; 936 pages; cloth. Published by National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass. Price $6.00.

The National Fire Codes are compilations of standards developed by the National Fire Protection Association, an international nonprofit organization devoted to the reduction of loss of life and property by fire. These standards are purely advisory as far as the National Fire Protection Association is concerned, but they are widely used as a basis of good practice by property owners and others for legal and insurance purposes in the United States, Canada, and other countries.

NEPA standards are intended to provide reasonable safety to life and property. They are prepared by technical committees made up of representatives of the various interests principally concerned with the respective standards. The committees include recognized technical experts in the respective fields, and are so organized as to produce standards which are generally accepted by all concerned as reasonable measures of fire safety.

This volume deals with standards pertaining to fire extinguishing equipment. Vol. I in the same series covers Flammable Liquids and Gases; Vol. II deals with Combustible Solids, Dusts, Chemicals and Explosives;



a thousand tons—or a million...

SOUTHERN has the coal you want.

In any quantity: 23 million tons a year, recovered at low cost at 27 modern mechanized mines.

From quality-proven seams and districts: Premium coals from the combined operations of Southern, Sinclair and Peabody Coal Companies in—Eastern and Western Kentucky; famous "five" seam, Indiana; the Wilmington, Northern, Central and Belleville districts, Illinois; and Ohio, Alabama, Iowa, Missouri and Oklahoma.

For Your specific needs: A wide choice of high BTU, low ash coals—laboratory tested products of quality controlled preparation—engineered for uniformly efficient performance in your particular type of Industrial, Commercial or Domestic equipment.

Let Southern's near-by representative give you cost-saving facts and figures on any quantity of your own specifications—delivered at favorable * shipping rates by barge, by rail, or rail-to-water through the Great Lakes to any destination in Mid-America.

* Through Yankeetown Dock on Ohio River, Indiana; Ken and Gibraltar Docks on Green River, Kentucky through all inland navigable rivers; over 12 major railroads and via Rail-to-Water Transfer Facility, Chicago.

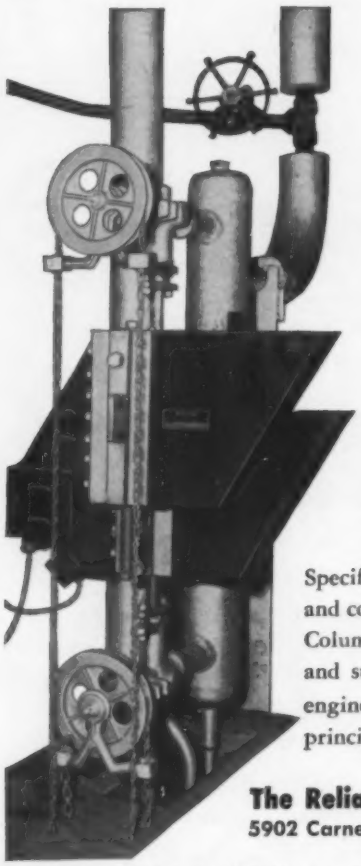
Southern
COAL COMPANY, INC.

GENERAL OFFICE: 333 NORTH MICHIGAN AVENUE, CHICAGO 1, ILLINOIS
OFFICES IN: LOUISVILLE, MEMPHIS, MINNEAPOLIS, NASHVILLE, ST. LOUIS
SINCLAIR COAL COMPANY, KANSAS CITY 5, MO., WESTERN REPRESENTATIVE

For more data circle 560 on Post Card

Reliance Water Columns

Gages and Safety Specialties assure you the utmost in *Dependability*



Since 1884, Reliance has maintained leadership in Boiler Safety Device development and manufacture. Water Columns with automatic Alarms, operated by the original *instantaneous* alarm mechanism, have helped to fortify power plants against the consequences of boiler water failure for billions of operating hours. Whistle alarms are available on columns for pressures to 900 psi; electric alarms, actuated by Reliance Electrode Levalarms, to 2500 psi.

For higher pressures — to 2500 psi — Reliance standard and custom-built equipment embodies principles of design and construction perfected in 70 years of *specializing* in this field—"super-rugged" Water Columns built with a generous margin of safety and tested at twice rated capacity.

Specified by many boiler manufacturers and consulting engineers, Reliance Water Columns exceed requirements of national and state code authorities . . . Reliance engineer representatives are located in all principal cities. Write for Bulletin 516.

The Reliance Gauge Column Company
5902 Carnegie Avenue • Cleveland 3, Ohio

Reliance Water Column Accessories, and Specialties

Water Gage Valves Gage (try) Cocks
Gage Inserts: Prismatic, Mica-protected Flat Glass, "Micasight"
Direct-to-Drum Water Gage Assemblies
Complete Line of Water Gage Illuminating Equipment
EYE-HYE Remote Reading Water Level Indicator — all pressures
Levalarms — Float-type Liquid Level Alarm Devices
Levalarms — Electrode-type Liquid Level Alarms, Fuel Cut-out and Pump Control

The name that introduced safety water columns....in 1884

Reliance®

BOILER SAFETY DEVICES

For more data circle 561 on Post Card

Engineering Books

continued from page 120

Vol. III with Building Construction and Equipment, and Vol. V covers Electrical Fire Alarm and Supervisory Service, Lightning Protection and Static Electricity.

Chapters in this volume (Vol. IV) include the following: — First Aid Fire Appliances, giving standards for installation, maintenance and use of extinguishers; Foam Extinguishing Systems, giving standards for foam extinguishing systems; Carbon Dioxide Fire Extinguishing Systems; Sprinkler Systems, giving standards for installation; Sprinkler Maintenance; Standpipe and Hose Systems, with standards for installation; Water Spray Systems; Wetting Agents; Motor Fire Apparatus; Centrifugal Fire Pumps; Steam Fire Pumps; Water Tanks for Private Fire Protection; Fire Department Hose Connections; Outside Protection; Valves Controlling Water Supplies; Private Fire Brigades; Gate and Check Valves; Indicator Posts; Hydrants; Vaporizing Liquid Extinguishing Agents; Portable Pumping Units; Volunteer Fire Departments, which includes sections on Equipment, Organization and Personnel, Model Ordinance and Rules, and State Legislation for organization. Then follow chapters on Aerial Ladder Testing; Fire Hose Couplings; Care of Fire Hose; Marking of Hydrants; Forest Fire Fighting Equipment; Water Systems for Fire Protection on Farms; Fire Fighting Equipment in Metal Mines; The Watchman, which gives a recommended manual of instructions and duties for the watchman on guard, and finally a chapter on salvaging operations.

* * *

Coördination, Control and Financing of Industrial Research, by Albert H. Rubenstein, Editor, 430 pages, 6 by 9 in.; cloth. Published by the King's Crown Press, Columbia University, New York. Price $8.50.

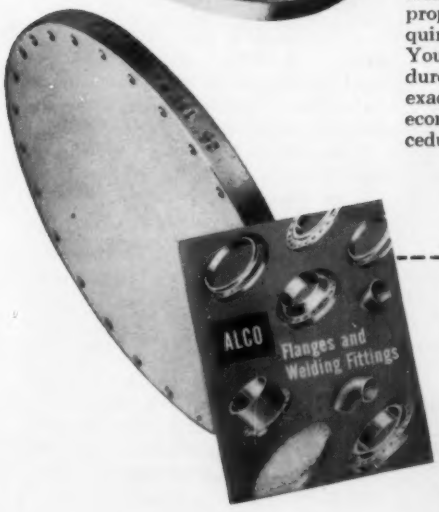
This book is the fourth in a series, reporting the proceedings of the Annual Conference on Industrial Research, sponsored by the Department of Industrial Engineering at Columbia University.

The first two volumes reporting the Conferences held in 1950 and 51 were entitled "Costs, Budgeting and Economics of Industrial Research" and "Selection Training and Use of Personnel in Industrial Research". The third volume, reporting the 1952 Conference, was entitled "Research Operations in Industry". All of these volumes are out of print.

No proceedings were published for the fourth Conference in 1953, consequently, selective papers from this Conference are included in this press volume. This volume discusses all aspects of industrial research. An idea of its contents may be had from some of its chapter headings as follows:

The current status of industrial research, coordination of research with sales, new

ALCO Makes Steel to Assure You of Quality in ALCO FLANGES



Steel made in ALCO's own open hearth furnaces is your guarantee of the exact metallurgy for your flange requirements. You benefit because ALCO controls deoxidation, grain size and creep properties, meets individual tensile requirements, provides proper grain flow. You save because your welding procedures can be standardized and because exact steel chemistries for the most economical preheat and postheat procedures are provided.

ALCO produces special steels not listed in standard specifications as well as steels to meet ASTM, AAR, ASME, AISI and MIL specifications. As an additional help, ALCO specialists will confer with you on proper steel selection.

For a complete look at ALCO flanges and welding fittings, send for ALCO's new 54-page catalog. It describes ALCO's production facilities and the wide range of sizes and types available.

ALCO PRODUCTS, INC.
NEW YORK

ALCO PRODUCTS, INC., P. O. Box 1065, Schenectady 1, N. Y.

Please send me my copy of ALCO FLANGES AND WELDING FITTINGS.

☐ For reference ☐ For immediate project

Name .....

Company .....

Address .....

City ..... **Zone** ..... **State** .....

For more data circle 562 on Post Card

Titusville

PIONEER

and LEADER

in SCOTCH MARINE

POWER BOILERS

Write for your copy of our Scotch Marine Power Boiler Bulletin B-3075A

The net to you is—A BETTER BOILER BUY! Our Scotch Marine pioneering over the years created the Titusville improvements that deliver outstanding performance for your application. Our largest-volume manufacture and sales bring you maximum dollar value in the boiler size and rating meeting your need. Let us give you the facts that tell the Titusville story!

TITUSVILLE IRON WORKS CO. TITUSVILLE, PA.

A division of Struthers Wells

THE TITUSVILLE IRON WORKS COMPANY

TITUSVILLE, PA.

Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement

For more data circle 563 on Post Card

Engineering Books

continued from page 122

product innovation and introduction — their broad implications, internal control of research operations, management of industrial research, the control of research funds, top management, senior partner in research, some key questions for the research administrator, the research revolution, what military research and development mean to industry, research project evaluation, application of high-speed computers to research problems, automatic data reduction, and operation of an industrial commuting facility. These titles are by no means all of those listed in the contents of this very interesting book.

Any manufacturing executive interested in promoting research in his own business should get a great deal out of reading this book.

★ ★ ★

Conversion Factors and Tables, Second Edition, by Drs. O. T. Zimmerman and Irvin Lavine. Cloth cover, 6¼ by 4½ in., 500 pages. Published by Industrial Research Service, Dover, N. H. Price $5.00.

First edition of this book was published in 1944. It was designed to provide, in one convenient volume, an accurate source of fundamental physical relationships as well as several thousand useful constants for the conversion of units.

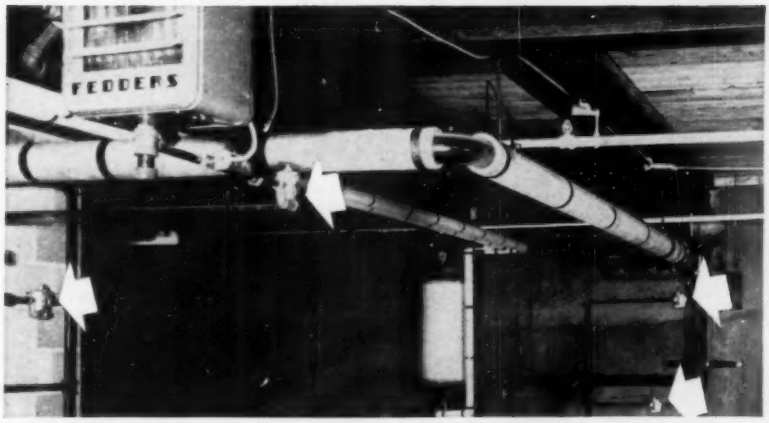
During the last ten years this book has been widely used in the United States and throughout the world. Although much of the material in the first edition is just as valuable today as when the book first appeared, a number of changes in the values of important physical constants made it desirable to recalculate all the factors in the book to bring them up to date. This has been done in this second edition. At the same time the book has been enlarged by the inclusion of considerable new material.

When the first edition appeared, it was thought that sales would be limited to the United States and other English-speaking countries. However, there has been great interest in this book in all countries of the world, and the authors have decided to include in this second edition a new section on foreign conversion factors.

Among the many new features of the second edition are:

1. An expanded conversion factor section in which all values have been recalculated based on the latest accepted fundamental values.
2. A section on conversion factors for most of the foreign countries of the world.
3. A section of foreign monetary equivalents.
4. A table of physical constants.
5. An expanded conversion table section. Not only have the conversion tables that appeared in the first edition been completely revised, but 14 new conversion tables have been added.

How One Company Has Saved $80,000 to Date by Buying 600 Steam Traps



Armstrong built-in strainer traps save maintenance as well as fuel at L. G. Balfour Co., Attleboro, Mass.

Joseph Brooks, Production Manager at Balfour, insists on "Armstrongs — *no substitute.*"

Armstrong Traps on Low Pressure, Vacuum Return Heating System Cut Fuel Costs $8,000 Per Year, Have Served 10 Years Without Repairs

YOU'D HAVE TO SELL a lot of fraternity pins to come out with $80,000 profit. But, that's the dollar-saving a couple of alert plant men have made by installing Armstrong steam traps at L. G. Balfour Company, fraternity jewelry makers of Attleboro, Mass. And, they've made their own jobs easier by doing it.

Just 10 years ago, Joseph Brooks, Production Manager, and C. J. Ripley, Maintenance Superintendent, installed the first Armstrong traps on their low pressure vacuum return heating system. Now they have 600 in use throughout the plant. The results have been an engineer's dream:

1. Fuel costs reduced $8,000 annually despite doubling of the factory's size and increased prices of coal.

2. One boiler did work of two after trap installation in original plant. Steam pressure was reduced from 50-75 lbs. to 22-27 lbs. Pressure is reduced to 4 lbs., with 6"-8" vacuum.

3. No trap repairs except cleaning in 10 years and no servicing of any kind where strainers were used ahead of traps. Armstrong Y-Type strainers have now been installed ahead of all No. 800 traps and all new traps are No. 880's with built-in strainer (costing less to buy and install than separate strainer and trap.)

This story of Balfour's $80,000 profit wouldn't be as significant if it were the only one of its kind. But, the frequency of such reports about Armstrong trapping establishes firmly the tremendous cost-reduction opportunities available to many plants throughout the country — perhaps to yours. Isn't it worth looking into?

Your local Armstrong Factory Representative or Distributor will survey your trapping without charge or obligation. Call him or write:

Bottom inlet and side inlet styles for all services.

ARMSTRONG MACHINE WORKS
810 Maple Street, Three Rivers, Michigan

FREE:
44-page Steam Trap Book —a complete guide to better trapping

ARMSTRONG MACHINE WORKS
810 Maple St., Three Rivers, Michigan

Please send me a "Steam Trap Book"

Name_____

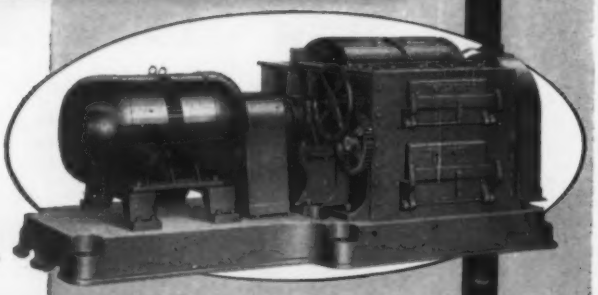
Company_____

Street Address_____

City_____ Zone____ State_____

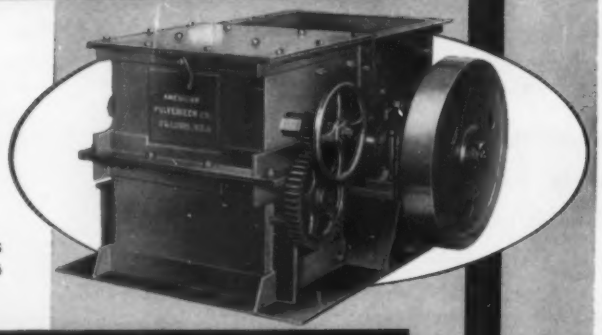
For more data circle 564 on Post Card

When You Figure . . .



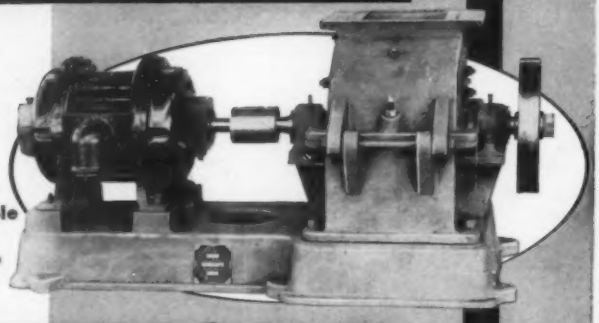
AC Series
capacities to
800 TPH

Reduction
Cost Per Ton . . .



WC Series
capacities to
90 TPH

the Best Answers*. . .



Coal Sample
Crushers
capacities to
2000 Lbs.
Per Hr.

Come from American
Ring Coal Crushers

*In a recent independent survey, it was found that American Crushers reduced over 61,000,000 tons of coal at a parts replacement cost (including standby parts) of *less than 1/10th of 1¢ per ton.*

THERE CAN BE NO BETTER PROOF OF AMERICAN QUALITY!

American
PULVERIZER COMPANY

WRITE for Literature on These Crushers

1431 MACKLIND AVE. • ST. LOUIS 10, MO.

For more data circle 565 on Post Card

EQUIPMENT NEWS

continued from page 64

29—LOAD TAP CHANGER is high capacity unit

This load tap changer is capable of handling transformer banks up to 1,300,000 kva, it is announced, for 20 per cent range in 32 steps. According to manufacturer, this development makes possible higher through-power ratings of load tap changing transformer banks to meet requirements of heavier transmission systems. The tap changer consists of a motor driven geared dial switch mounted on side of tank, a conventional cam operated circuit breaker located below dial switch compartment, and a motor driven mechanism which operates circuit breaker and dial switch intermittently. To expand beyond the practical 400,000 kva operating capacity limit of plain unassisted contacts, the Ruptor arcing principle, which was developed for heavy transmission type circuit breakers, is used. Entire tap changer unit is designed for millions of operations under normal service. Allis-Chalmers Mfg. Co.

30—PLUG-IN ADAPTER for clamp volt-ammeter

This plug-in adapter is designed to extend use of company's Model 749, a miniature a-c clamp volt-ammeter. Adapter has plug receptacles on either side; one of which reduces scale range of

the Model 749 by a factor of 10, permitting low current measurements. Receptacle on the other side is for reading ampere scale directly (1:1). For measuring current consumption of motors, appliances and circuits, adapter is plugged into a-c line, appliance connected to adapter, and clamping jaws of instrument inserted through adapter opening. Voltage readings also are quickly made by plugging probes of Model 749 into plug receptacles on either side. Weston Electrical Instrument Corp.

31—CEILING DIFFUSER IS adjustable from floor

Model BP Venturi-Flo features a variation of air patterns from horizontal to vertical and is declared capable of driving hot air to the floor from mounting heights up to 50 ft, even with temperature differentials as high as 40 F. Greater

projection of warm air is possible with lower temperature differentials. Because it is adjustable, and capable of long vertical throws, it is suggested for use in manufacturing areas, auditoriums and similar structures. Adjustment can be made from the floor to provide air patterns ranging from vertical to horizontal. When this is not practical, an adaptor unit can be furnished to permit adjustment through the duct from the crawl space above ceiling. Catalog F 7722 gives data. Barber-Colman Co.

Reader Service Cards on pages 133–134 make it easy to get further information on any of these products. Just circle the item numbers of the products you want to know more about.

32—ROTARY FEEDER for the chemical applications

This rotary feeder with integral, variable speed drive is reported to have withstood handling of hot, abrasive chemicals containing hydrofluoric acids at 10 psi, and to be particularly suited to bulk chemical services. Two models are available: a standard one for plus or minus pressures up to 3½ psi and a peripheral seal type for pressures to 10 psi. Both models have eight pockets and outboard bearings of sleeve or anti-friction type with packing of cotton, spring loaded rawhide, asbestos or Teflon. Both are available in 4- to 12-in. sizes. The peripheral seal model has a self-adjusting seal made of Teflon. Motors for feeders vary with material and size of feeder. Both standard or explosion-proof models can be furnished. Beaumont Birch Co.

33—SWITCHBOARD CLOCK with synchronous self-starting motor

Catalog 31 Switchboard Clock consists of a synchronous self-starting motor with sweep second hand. A front reset knob is provided, and connections are made to two studs on the rear. Clocks are 60 cycle, and are available in 120-v and 240-v models. Case design is claimed to eliminate scale shadow caused by overhead lighting. An additional clock-operated timing switch, which can be set from the front, is available for closing a circuit, such as process timing or an audible alarm. A front panel knob places the external circuit in "on-off" or "automatic." Switch contacts are rated at 15 amp 125 v, a-c. The complete unit is in a dust-tight case for permanent installation on all type switchboards. The clock matches General Electric switchboard instruments Types AB-18 and DB-18 in appearance and mounting. Sunshine Scientific Instrument.

34—STAINLESS STEEL VALVE is two-way globe type unit

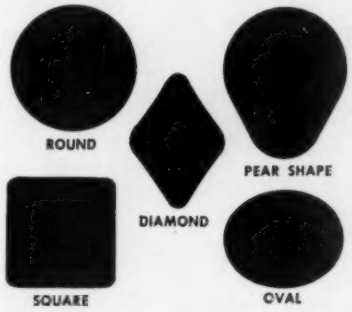
Designed to operate at pressures from 10 to 3000 psi, this 1-in. stainless steel valve is a two-way globe type, pilot operated solenoid valve with packless construction. The standard model is normally closed; but with modification, can be made normally open through 300

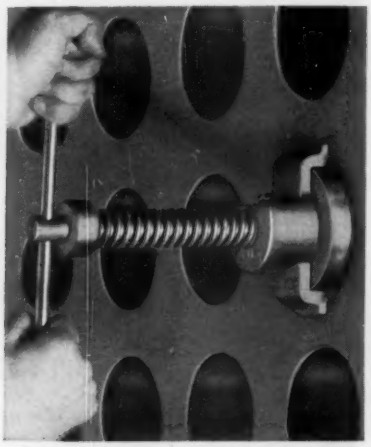
ROTO *Hand Hole* Seat Scraper

Eliminates Dirty, Tedious Work

Here is a simple, hand-operated tool for cleaning inside caps on boilers that will pay for itself many times over. This tool is equipped with retractable knives mounted on a revolving spindle having a bearing within a substantial yoke. An adjustable spring automatically maintains tension on the knives, sufficient to remove all foreign matter but not enough to cut the metal. A few turns to the right, and the job is done. A half turn to the left releases the tool. Try a Roto Seat Scraper and you'll wonder how you ever got along without one.

These are some of the hand hole shapes cleaned with a Roto Seat Scraper. Various sizes available.





Illustrating ease of operation of Roto Hand-hole Seat Scraper.

Roto Hand-hole Seat Scraper for B & W Boiler.

What Users Say—

It did a fine job. Completed the work in 80% less time.
(Engineer, Chemical Plant)

Roto Seat Scraper has paid for itself many times over on our Keeler Boiler.
(Supt., Public Utility)

One man cleaned inside cap seats on boiler header in 4 hours. Formerly took 2 men 3 days.
(Pennsylvania Manufacturer)

We also make a Reseating Machine for cleaning outside caps to assure a smooth, true fit. Send for details.

SEND FOR BULLETIN

ELLIOTT COMPANY - ROTO DIVISION
Tube Cleaner Specialists Since 1910
147 Sussex Avenue, Newark, N. J.

For more data circle 566 on Post Card

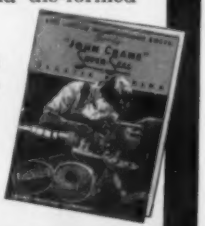
SUPER SEAL No. 1 PLASTIC PACKING

Here is the answer to the plant operator's need for a completely satisfactory packing for temperature conditions up to 550°F. It is the finest sealing packing available. By itself —or in combination with a more dense packing—it is the perfect packing for use throughout the plant in condensate, boiler feed, heater drain, circulating and evaporating pumps.

Super Seal is a combination of non-frictional metal particles and asbestos fiber . . . graphite impregnated and bonded together with special resilient binders to meet specific service conditions. It contains no volatiles. Nothing can be squeezed out or driven off under heat. It will not dry out or harden.

Other types of Super Seal are available for handling acids, alkalis and solvents, also oil, distillates, fruit juices and similar services. Supplied in spirals, coils and die-formed rings to fit all stuffing boxes.

Have "John Crane" engineers recommend the style Super Seal Packing best suited to your service. Request catalog.



Crane Packing Company, 6429 Oakton Street, Morton Grove, Illinois, (Chicago Suburb).
In Canada: Crane Packing Co., Ltd., Hamilton, Ont

JOHN CRANE CRANE PACKING COMPANY
OFFICES IN ALL PRINCIPAL CITIES

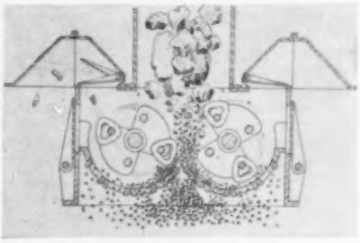
For more data circle 567 on Post Card

psi; and with the use of a relay, to 3,000 psi. With a relay, power must be supplied at all times, since the valve will not open on power failure.

There are two variations: Type SS, with a standard coil, for operation to 300 psi; or Type HPSS, with a high pull coil, for applications to 1500 psi. Over 1500 psi, and to 3000 psi, a double wound coil and relay are required. The function of the relay is to energize a primary winding, giving a strong impulse to open the pilot valve. The secondary winding is then cut in, holding the valve open at low current consumption. Outstanding features announced include high corrosive resistance, ability to operate at high pressures, and full ported construction to allow maximum flow at maximum rated pressure. Atkomatic Valve Co., Inc.

35—CRUSHER offers increased efficiency, non-clogging features

Using a pair of rotors with triangular crushing sectors rotating in opposite directions, the Double Rotor Knittel Crusher is designed to combine effectiveness of a double roll crusher with slugging teeth with the inherent advantages of the hammermill type crusher. Opposing rotation of the twin rotors tends



to draw coal through the crusher, with heavy sectors breaking up lumps by impact. This is declared similar in results to action of slugging teeth on most double roll crushers. Following impact breakage, coal falls to the grate bars where the heavy sectors force it through, reducing it to the desired size.

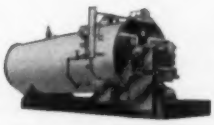
An advantage claimed for this crusher is ability to handle wet and sticky coal without clogging — there are no breaker plates upon which sticky material can build up, it is pointed out. The crusher is reported to show excellent horsepower per ton performance. Also of significance is its ability to automatically dispose of tramp iron, company notes; since tramp iron cannot be driven through the grate bars, the hanging sectors drive it against a battery of fingers which lift out of the way, allowing material to drop in a box. Stephens-Adamson Mfg. Co.

36—MICRONIC FILTERS have quick-opening cover design

Series QS Filter Housings are designed for high capacity diesel full flow lube systems. Features announced are easy maintenance, effective micronic filtration, high flow rates and lower cartridge replacement cost. The quick-opening cover permits easy cartridge changes, says manufacturer: one man can simply drop the swing bolts, lift the cover arm, swing the cover aside and remove the cartridges in minutes. Replaceable cartridges used have graded density construction for greater dirt holding capac-

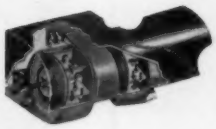
MINIMUM INSTALLATION COST
MINIMUM MAINTENANCE COST
MINIMUM OPERATING COST *and*

MAXIMUM EFFICIENCY



TESTED AND READY

Not just completely factory assembled, but completely fire tested at the factory before shipment . . . and guaranteed on the basis of this test.

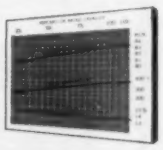


BUILT TO LAST

Bigger, heavier, and designed to last . . . indicative of this is the slow speed induced draft fan integrated in the design of the boiler.

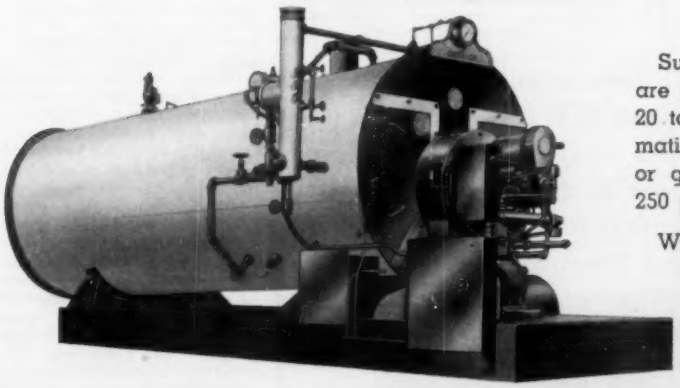
FULLY AUTOMATIC BURNING OIL OR GAS OR BOTH

The economy of firing that follows the load is increased by the ability to change over from one fuel to another to compensate for fluctuations in the market.



80% THERMAL EFFICIENCY GUARANTEED

Based on its own individual factory test, every Superior Steam Generator is guaranteed to achieve its maximum rated capacity at thermal efficiencies in excess of 80%.



Superior Steam Generators are available in 18 sizes from 20 to 600 b.h.p. for fully automatic operation burning oil, or gas, or both. Pressures to 250 p.s.i.

Write today for Catalog 806.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

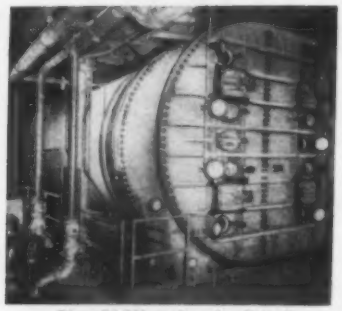
SUPERIOR
STEAM GENERATORS

For more data circle 568 on Post Card

The BIGGER the BETTER

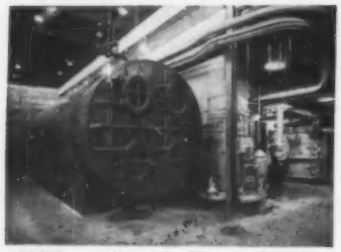
CONSECO

CONDENSERS

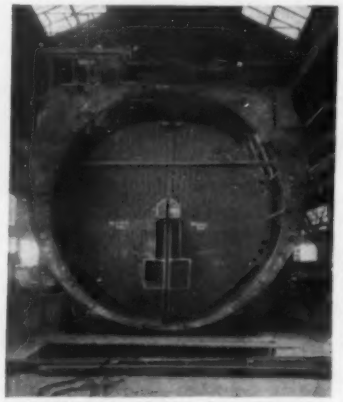


Three 70,000 sq. ft. units, City of Los Angeles, Cal.

One 45,000 sq. ft. unit and two 20,000 sq. ft. units, Puerto Rico Water Resources.



28,000 sq. ft. unit, City of Owensboro, Kentucky.



33,000 sq. ft. unit, Penn Power Company, Newcastle, Pa. Under Construction.

33,000 sq. ft. unit Penn Power Company, Newcastle, Pa. Installed.

OTHER INSTALLATIONS INCLUDE

One 30,000 sq. ft. unit, Northern Sate Power Corporation.
One 35,000 sq. ft. unit and three 12,000 sq. ft. units, for Dairyland Power Corporation.

UNDER CONSTRUCTION

One 45,000 sq. ft. unit for Transit Authority, N. Y. C.
One 35,000 sq. ft. unit for Maryland Power Corporation.
One 27,000 sq. ft. unit for City of Detroit, Michigan.

NO matter what size units you need, CONSECO gives you what it takes to produce them . . . experienced engineering, sound design, dependable manufacture, better performance . . . at lowest ultimate cost. *Descriptive Bulletins on request.*

CONSECO DESIGNS AND BUILDS

Heat Exchangers • Condensers • Evaporators • Steam Jet Air Ejectors • Steam Generators • Pressure Vessels • Centrifuges Filters • Strainers • Pumps • Instruments and Specialties.

CONDENSER SERVICE & ENGINEERING CO., INC (CONSECO)

Designers and Builders of Equipment for Power, Refining, Chemical and Marine Industries

158 OBSERVER HIGHWAY
HOBOKEN, N. J.

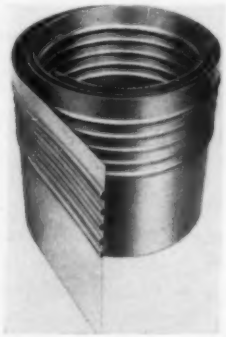
For more data circle 568 on Post Card

ity and long service. Degrees of filtration using these cartridges are 5, 10, 25 or 50 microns.

Flow capacities for single housings are high, it is noted. Largest of the QS Series has a flow rate of 500 gpm of clean oil at 150 SSU, 25 micron filtration and a pressure drop of only 2 psi. This unit measures only 2½ ft across flanges and 4½ ft high. Company engineers recommend that filters in this series be preceeded by their Super Auto-Klean on full flow applications. With it, particles larger than 37 microns may be removed first; leaving the cartridges free to do the work for which they are designed — removing 5 to 10 micron size particles. Cuno Engineering Co.

37—TUBE STRIP is made from sheet of non-ferrous metal

Tube-in-Strip comes in a single strip, or sheet, of solid copper, brass or aluminum in which tubes are inflated to desired running lengths in a variety of shapes or sizes. Product is said to have almost limitless applications in the heat exchange field, including refrigeration and air conditioning, chemical, food and petroleum processing, water heaters and coolers, gas heaters, radiant panel heating. Except for expandable portions,



metal is a solid strip derived from a suitably treated casting. It can be stamped or drawn into desired shapes prior to expansion of channels. Expanded channels can be made circular in section, or during expansion metal can be forced into dies producing other than circular sections. It is also possible to inflate channels on one side of strip or sheet only, leaving other surface flat.

Strip is now furnished in long coils or in cut flat sheets in widths up to 16 in. Tube spacing, it is explained, can be as close as ¼ in., and as widely apart as width of metal permits. Inside diameters can vary from about $\frac{3}{16}$ to $\frac{5}{8}$ in., when unexpanded. Tube wall gage can vary from 0.0025 in. to whatever inflation equipment permits. Strip will be shipped uninflated — inflation techniques are described as flexible and simple. It is pointed out that web between tubes conducts heat faster, and that increased structural strength made by inflated channels means that lighter gage metals can be used, with savings in weight. Revere Copper and Brass Inc.

38—PRESSURE GAGE for high temperature uses

Model C Pressure Gage is described as capable of giving continuous and accurate readings under prolonged exposure to high temperature and radiation.

Available in standard and special pressure ranges, it is designed for a-c operation, 60 to 400 cycles in continuous radiation flux of one million Roentgens per hour. The gage may be installed on any pipe or vessel for use with high temperature liquids or gases, and the pressure-sensing bellows may be made from a variety of materials.

The instrument consists of the bellows, a differential transformer and a meter to indicate variations in transformer output. Bellows and transformer constitute one compact unit connected by cable to the receiver — either a direct-reading or a recording meter. The gage measures changes in electrical output in the secondary of the differential caused by movement of the core, which is linked to the bellows. Any change in pressure on the bellows causes a directly proportional movement of the core which, in turn, induces a variation in the transformer output. The gage is not temperature sensitive, it is noted, and the bellows, located just below transformer, also serves as secondary seal. Bulletin PG-2 gives data on this gage. Callery Chemical Co.

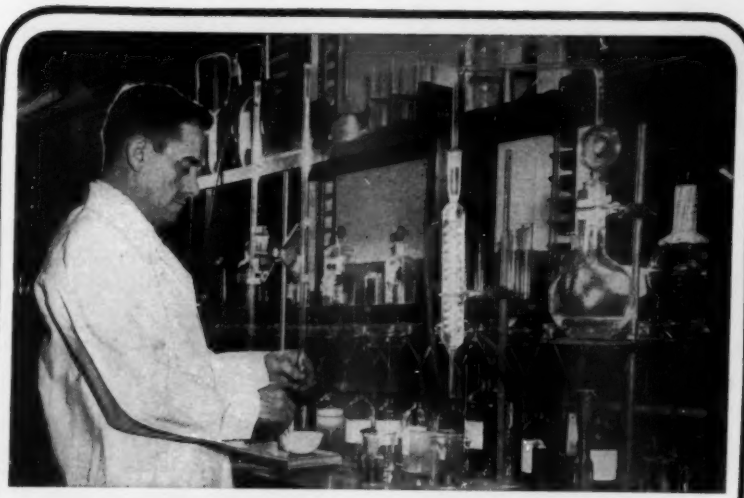
39—LIGHTING UNIT provides emergency illumination

This explosion proof lighting unit is designed to provide emergency illumination instantly and automatically whenever the regular source of power fails. Electrical components are housed in explosion-proof equipment. The heavy cast explosion proof battery case contains breathing vents and is furnished with a 6-v 60-amp hour nickel cadmium battery. Explosion proof heads for ceiling, pendant or wall mounting can be mounted remotely from the unit. Unit can support a total of five heads. Automatic in operation, unit contains no manually operated controls or timers. With two heads it will furnish approximately 7½ hr of continuous emergency light. Electric Cord Co.

40—MATERIAL LEVEL INDICATOR for the process industries

This material level indicator functions at bin temperatures to 300 F, it is announced. Suitable for all dry, pulverized, crushed or granular materials, it can be adapted for use with corrosive materials. The indicator may be mounted vertically or horizontally. The indicator mechanism consists of a paddle wheel rotated by a 10-w motor. When incoming material reaches the paddle wheel level, shaft movement is restrained. The motor, located externally, revolves on its shaft until it contacts two micro switches which flash a signal to operator or directly to feed supply.

It is explained that because the motor frame must rotate through a considerable distance before contacting the switches, false signalling, caused by clumps of material striking the paddles, is avoided. Even when the paddle is held stationary by the material, electric current to motor is not interrupted, says company. For low-level control, when a bin is being unloaded, the paddle wheel is held motionless — and the motor held against the switches — until the material restraining it falls away. A tension spring then returns the motor to its original position and the paddle revolves. Fuller Co.



PORTFOLIO OF BIRD-ARCHER ENGINEERING SERVICES FOR WATER TREATMENT

For experienced counsel and personal attention to water or steam problems at your plant, it will pay you to call on Bird-Archer's qualified engineers. Highest quality chemicals and over sixty years experience assure maximum results with Bird-Archer's Complete Water Treatment Service.

PLANT SURVEY
Studies of your use of water or steam equipment and past performance.

WATER AVAILABILITY STUDY
Analysis of water supplies starting at source.

LABORATORY SERVICE
Experienced chemists specialize in scientific water analyses and research.

DEVELOPMENT OF TREATMENT AND CONTROL SYSTEMS
Operational changes where necessary.

CHEMICAL TREATMENT FORMULATION
Bird-Archer custom formulates chemical treatments for your specific problems.

EQUIPMENT RECOMMENDATIONS
Specification and furnishing of additional equipment when necessary, including complete analysis of savings and benefits made possible.

PLANT STAFF INSTRUCTION
Experienced technicians instruct your personnel in accurate control and test procedures.

PERIODIC CHECK-UPS
Personal call-backs to your plant by a Bird-Archer Service Engineer to assure best possible results.

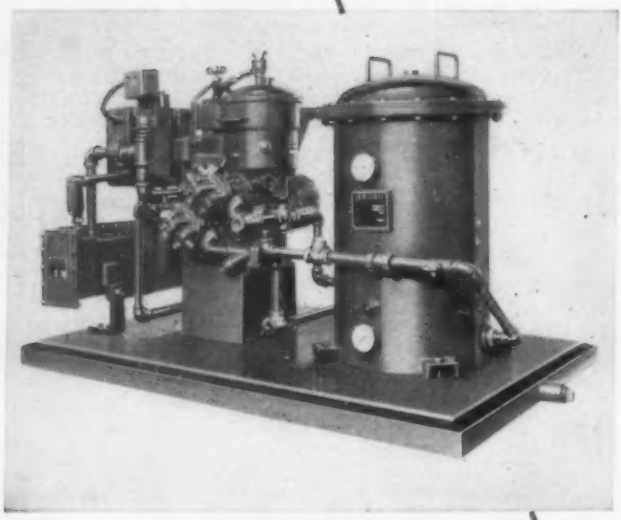
WRITE FOR LITERATURE

ENGINEERING PLUS CHEMISTRY EQUAL BIRD-ARCHER SERVICE
For Power For Process For Cooling

BIRD-ARCHER
WATER TREATMENT
THE BIRD-ARCHER COMPANY, 4337 N. AMERICAN ST., PHILADELPHIA 40, PA.
NEW YORK • CHICAGO
IN CANADA: The Bird-Archer Co., Limited, Cobourg, Ontario
BIRD-ARCHER COMPANY OF CALIFORNIA, San Francisco

For more data circle 569 on Post Card

YOUR DIESEL LUBE OIL
+
A DE LAVAL "PURI-FILTER"
adds up to greater
EFFICIENCY...ECONOMY...PROFITS!



Just one machine—the De Laval "Puri-Filter"—can give your diesel lube oil the *full treatment!*

The "Puri-Filter" keeps oil dry...keeps it clean... removes solid contaminants and gum-forming solids ...takes out colloidal carbon and other minute solids down to one micron (0.000039 in.) in size!

And it does all this with *one pass...without affecting oil-soluble additives!*

There's more! The De Laval "Puri-Filter" helps prevent ring sticking...prolongs oil life...stretches intervals between ring cleaning...gives you operating economy and efficiency all down the line.

Get all the money-making facts now...***write for the "Puri-Filter" Bulletin today!***

DE LAVAL
lubricating oil purifiers

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

For more data circle 570 on Post Card

CATALOG LIBRARY

Standard catalogs listed monthly to help you maintain a reference library

BOILERS, GENERATORS

201 **Packaged Boilers** — This 16-pp illustrated catalog describes manufacturer's new Type VP package boiler. Following a section of background information is an outline of the principal design features of these boilers, which are shop assembled and provide steam capacities from 4000 to 40,000 lb per hour. Space requirements are shown in a table along with typical specifications. Also described is control system. Combustion Engineering, Inc.

202 **Automatic Boilers** — Bulletin BE-4 describes operation and advantages of Continental automatic boiler's spinning gas technique — a method of obtaining maximum heat transfer with a simplified design. Shows cutaway view of boiler construction; illustrates hinged doors and method of injecting air through static, turbine-like vanes into burner. Boiler Engineering & Supply Co., Inc.

203 **Self-Contained Boilers** — Bulletin AD-144 reviews company's new CB boilers. Illustrations include installations, demonstrations. Engineering articles are featured covering such subjects as low noise level. Cleaver-Brooks Co.

204 **Compact Generator** — This bulletin describes a packaged water tube generator, company's Type DK, available in units for 8400 to 45,000 lb of steam per hour. Gives features, size and capacity data on these boilers which are designed to require less space than many water tube units. E. Keeler Co.

205 **Improved Steam Generator** — Bulletin 2000, 28 pp, explains advance design features that distinguish this manufacturer's generator from other unit steam generators. Describes and illustrates engineering differences of component features. Also shows how these components are constructed, assembled and tested. Another section gives data, and dimensions for the units which range from 20 to 6000 hp. Preferred Utilities Mfg. Corp.

It's easy to get these free catalogs—just circle item numbers of those wanted on the postcard at right.

206 **Steam Generators** — Illustrated Bulletin SB43, 20 pp, describes company's VL factory assembled generators combining 2-drum water-type boiler, integral water cooled furnace, brick work, insulation and steel casing. A large cutaway illustration shows design details, and gas travel. Erie City Iron Works.

207 **Steam Generator** — This manufacturer's new Type D steam generator, a packaged unit for pressure firing with

APRIL, 1956
Card void after
September 30, 1956

POWER ENGINEERING

Please have the manufacturers send me without obligation information or bulletins indicated by the numbers circled below.

Name.....Title.....
Company Name.....
(Must be included)
Company Address.....
City.....State.....
(If you prefer delivery at home, give home address, too)
Home Address.....
City.....State.....

Helpful Bulletins

Equipment							
1	2	3	4				
5	6	7	8				
9	10	11	12				
13	14	15	16				
17	18	19	20				
21	22	23	24				
25	26	27	28				
29	30	31	32				
33	34	35	36				
37	38	39	40				
41	42	43	44				
101	102	103	104	105	106	107	
108	109	110	111	112	113	114	
115	116	117	118	119	120	121	
122	123	124	125	126	127	128	
129	130	131	132	133	134	135	
136	137	138	139	140	141	142	
143	144	145	146	147	148	149	
150	151	152	153	154	155	156	
157	158	159	160	161	162	163	
164	165	166	167	168	169	170	
171	172	173	174	175	176	177	

Catalog Library

201	202	203	204	205	206	207	208	209	210	211
212	213	214	215	216	217	218	219	220	221	222
223	224	225	226	227	228	229	230	231	232	233
234	235	236	237	238	239	240	241	242	243	244
245	246	247	248	249	250	251	252	253	254	255
256	257	258	259	260	261	262	263	264	265	266
267	268	269	270	271	272	273	274	275	276	277
278	279	280	281	282	283	284	285	286	287	288
289	290	291	292	293	294	295	296	297	298	299

Advertised Products and Services

501	502	503	504	505	506	507	508	509	510	511
522	523	524	525	526	527	528	529	530	531	532
543	544	545	546	547	548	549	550	551	552	553
564	565	566	567	568	569	570	571	572	573	574
585	586	587	588	589	590	591	592	593	594	595

512	513	514	515	516	517	518	519	520	521	
533	534	535	536	537	538	539	540	541	542	
554	555	556	557	558	559	560	561	562	563	
575	576	577	578	579	580	581	582	583	584	
596	597	598	599	600	601	602	603	604	605	

Use this space to ask for tear sheets and other information. .....

FIRST CLASS
PERMIT No. 353
SEC. 349 P.L.&R.
CHICAGO, ILL.

CHICAGO 3, ILLINOIS
110 South Dearborn
POWER ENGINEERING

POSTAGE WILL BE PAID BY—

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

gas, oils, or combination of fuels, is described in an 8-pp catalog. Gives complete data and dimensions on this water tube generator which is available in 17 sizes with capacities from 8000 to 40,000 lb of steam per hour. Fully illustrated, booklet explains economical steam production. Superior Combustion Industries, Inc.

VALVES, TRAPS, PIPING AND ACCESSORIES

208 Check Valves — Twenty-pp Catalog 30 presents company's line of tilting-disc check valves made in iron, bronze and steel for working pressures to 3000 psi. Explains operating principles of tilting disc construction, discusses closing without slam, reduced loss of head, other advantages. Includes construction details, sizes. The Chapmnn Valve Mfg. Co.

209 Lubricated Plug Valves — Revised Catalog PV-2, 12 pp, presents steel and semi-steel valves designed to offer quick shut-off of erosive or corrosive fluids. Explains advantages of the lubricated tapered plug design of these valves and pictures single gland, screwed gland, and bolted gland types. Also shows accessories. The William Powell Co.

210 Blow-Off Valves — Bulletin B-426, 20 pp, on blow-off valves for boiler pressures up to 400 lb wsp, contains installation recommendations, construction information on Yarway seatless and double-tightening blow-off valves. Gives full ordering data. Yarnall-Waring Co.

211 Valve Chart — Form 194, 24 pp, is a valve comparison chart, listing valve figure numbers of 15 major manufacturers and the OIC equivalent valve figure numbers. Compares variety of valves in ferrous and non-ferrous materials, describes different valve lines. The Ohio Injector Co.

212 General Purpose Valves — Supplement No. 1 to Catalog F-9, 32-pp, offers complete information on company's series of general purpose drop forged steel valves, gate, globe and angle types, sizes ¼ through 2 in. Includes descriptions of each type along with drawings showing component parts. Dimensions and other specifications are tabulated, and a pressure-temperature ratings table is included. Henry Vogt Machine Co.

213 Valve Charts — Now available to power engineers are three well-organized wall charts on valve types, selection and protection. "How to know valves" covers four main types of valves from the standpoints of their appearance, inside construction, service intended, operation and use. "How to select valves" discusses five major factors involved in the choice of a valve — fluid, temperature, pressure, size and function. "How to protect valves" — written in "do and don't" style covers 11 important points in valve installation, operation and maintenance. R-P & C Valve Div., American Chain & Cable Co., Inc.

214 Choosing the Right Valve — Presenting valve selection as a matter of matching the valve's service characteristics with service requirements of the job, this practical 20-pp booklet explains and illustrates basic design features of gate, globe and check valves. It tells, in non-technical language, how each of these valve types works, and where it is suited for use. Disc, stem connection, bonnet and bonnet-joint characteristics are discussed. Crane Co.

APRIL, 1956
Card void after
September 30, 1956

POWER ENGINEERING

Please have the manufacturers send me without obligation information or bulletins indicated by the numbers circled below.

Name.....Title.....
Company Name.....
(Must be included)
Company Address.....
City.....State.....
(If you prefer delivery at home, give home address, too)
Home Address.....
City.....State.....

Equipment

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
33	34	35	36
37	38	39	40
41	42	43	44

Helpful Bulletins

101	102	103	104	105	106	107
108	109	110	111	112	113	114
115	116	117	118	119	120	121
122	123	124	125	126	127	128
129	130	131	132	133	134	135
136	137	138	139	140	141	142
143	144	145	146	147	148	149
150	151	152	153	154	155	156
157	158	159	160	161	162	163
164	165	166	167	168	169	170
171	172	173	174	175	176	177

Catalog Library

201	202	203	204	205	206	207	208	209	210	211
212	213	214	215	216	217	218	219	220	221	222
223	224	225	226	227	228	229	230	231	232	233
234	235	236	237	238	239	240	241	242	243	244
245	246	247	248	249	250	251	252	253	254	255
256	257	258	259	260	261	262	263	264	265	266
267	268	269	270	271	272	273	274	275	276	277
278	279	280	281	282	283	284	285	286	287	288
289	290	291	292	293	294	295	296	297	298	299

Advertised Products and Services

501	502	503	504	505	506	507	508	509	510	511
522	523	524	525	526	527	528	529	530	531	532
543	544	545	546	547	548	549	550	551	552	553
564	565	566	567	568	569	570	571	572	573	574
585	586	587	588	589	590	591	592	593	594	595

512	513	514	515	516	517	518	519	520	521
533	534	535	536	537	538	539	540	541	542
554	555	556	557	558	559	560	561	562	563
575	576	577	578	579	580	581	582	583	584
596	597	598	599	600	601	602	603	604	605

Use this space to ask for tear sheets and other information.

.....
.....

FIRST CLASS
PERMIT No. 353
Sec. 34.9 P.L.&R.
CHICAGO, ILL.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY—

POWER ENGINEERING

110 South Dearborn

CHICAGO 3, ILLINOIS

216 Steel Gate Valves — Four types of Hancock general purpose steel gate valves for process and power piping systems are described in illustrated Bulletin 202 C, 12 pp. Material specifications, dimensions given, also service pressure ratings. Manning, Maxwell & Moore, Inc.

217 General Service Valves — Bulletin E-160, 16 pp, describes and illustrates design and construction of company's quick-operating valves, explaining their application to blow-off service and on chemical process, soot blowers, water column blow-down, and other types of pipe line. Everlasting Valve Co.

219 Solenoid Pilots — Several types of solenoid pilots for use with company's regulating valves are described in Form 1010. Lists reasons for economies in on-off control, describes applications, and gives type of pilot, material of construction, maximum pressure and maximum temperature for two- and three-way pilots in steam, air, gas and liquid service. Schematic diagrams of typical applications are given. Spence Engineering Co., Inc.

220 To Get at Those Valves — This little folder describes a sprocket rim with chain guide. The rim adjusts to fit all valve wheels. Babbitt Steam Specialty Co.

221 Steam Trap Book — Catalog J, 44 pp, serves as a manual of trapping practice. Includes a catalog section giving physical data and prices on cast semi-steel and forged steel inverted bucket steam traps, compound steam traps and ball float air and air relief traps; a handbook section explaining how to calculate condensate loads and select traps for all classes of equipment; a maintenance section explaining trap installation, trouble-shooting and repair. Armstrong Machine Works.

222 Steam Trap Solutions — Bulletin F. 151, 36 pp, is a newly revised edition of this company's well known booklet, "Solving Steam Trap Problems." Organized for easy reference, this illustrated booklet provides specifications and capacities of steam and float traps, air release valves, pipe line strainers. Tells how to calculate condensation loads and select traps for unit heaters, jacketed kettles, submerged surfaces. Gives tips on installing, servicing. The V. D. Anderson Co.

223 Flexible Ball Joint — Catalog 215-B, 20-pp, describes advantages of company's flexible ball joints for use in piping for power, process, heating, chemical, construction, or hydraulic service. Includes engineering specifications and data on the standard 300 lb series and the series 600. Screwed, flanged and welding end joints are listed, as are insulating joints and jacketed joints for handling asphalt and other liquids that solidify unless heated. Barco Mfg. Co.

225 Asbestos-Cement Pipe — Manufacturing methods in producing asbestos-cement pipe for water systems are described in this 8-pp bulletin, which points out savings in installation time and outlines characteristic advantages once the pipe is in the ground. Recommended procedures for installing pipe and assembling Ring-Tite coupling, as well as table of sizes and fittings are included. Johns-Manville.

226 Stainless Steel Pipe Fittings — Bulletin S-3-55 describes company's 150 lb stainless steel pipe fittings for corrosive, high and low temperature service, including 90 deg elbows, tees, 45 deg elbows,

You Can Be Sure of STRONGER REFRACTORY LININGS

after you apply

SUPER #3000 Refractory Bonding Cement

• For Setting Fire Brick

Strongest, most abrasion-resistant at low, medium and high temperatures to 3000° F.

Volume-stable; does not shrink or crack.

Makes tight joints that prevent passage of gases into furnace walls. Used as a wash coat, it protects the firebrick against erosion.

• On Inside Duct Lining

A ¾" thick layer over insulation provides long-life lining that withstands hot abrasive gases.

• On Induced Draft Fan Casings

Where formerly repairs required heavy steel plates, now a Super #3000 coating provides safe protection against fly ash.

• On Boiler Tubes

By painting the tubes (in the second and fourth pass of the boiler) with a thin mix of Super #3000, protection is provided against erosion.

Super #3000, the truly all-purpose, ready-mixed bonding mortar that has proved its superiority on thousands of tough jobs, challenges your investigation. *Let us send you a drum for test.*

REFRACTORY & INSULATION CORP.

R&Q

REFRACTORY BONDING AND CASTABLE CEMENTS
INSULATING BLOCK, BLANKETS AND CEMENTS

130 WALL STREET • NEW YORK 5, N. Y.

For more data circle 571 on Post Card

crosses, couplings, reducers, pipe caps, unions, plugs and bushings. Presents dimensional specifications in sizes ⅛ to 2 in. in both screw end and socket welding types. Applications in chemical plants, refrigeration service, food and other process piping given. Watson-Stillman Fittings Div., H. K. Porter Co., Inc.

227 Pipe Insulation — MonoKover, a lightweight one-piece pipe insulation, is described in this bulletin. Photos show how easily it is applied, and text covers its thermal resistance, permanence, resiliency, non-corrosive properties and lower applied cost. Also included are a thermal efficiency chart, insulation thickness selection table, and information on sizes and thicknesses available in this material. Baldwin-Hill Co.

228 Piping Insulation — Seven-pp Bulletin SO 1054 features a snap-on, one-piece molded pipe insulation of fine glass fibers for hot or cold piping. Specifications are given for industrial, commercial, and institutional piping where maximum efficiency is of primary importance and for hot water and low pressure steam. Gustin-Bacon Mfg. Co.

TUBING AND ACCESSORIES

229 Rotary Tube Cleaners — Bulletin R-105 presents air and water driven rotary tube cleaners and cleaner accessories. Illustrates several models and heads. Roto Div., Elliott Co.

230 Nickel Pipe and Tubes — Bulletin T-17 is a 28-pp technical bulletin on the fabrication and design of nickel and high nickel alloy pipe and tubing, illustrated throughout by drawings and photos. Presents tables on mechanical and physical properties, ASME code requirements, recommended welding procedures. The International Nickel Co., Inc.

231 Life Extension for Condenser Tubes — The 32-pp current edition of this booklet reports on research into the causes of corrosion and means of combating them, as well as the choice of condenser tube materials. Points out that Admiralty metal, long a standard for power plant condenser tubes, works satisfactorily in most installations, but other alloys may be necessary in some circumstances. Revere Copper and Brass, Inc.

232 Tube Cleaners — Catalog 76-A provides 48 pp of information on manufacturer's line of tube cleaners. Following equipment selection and operating hints, this practical catalog describes and pictures cutter heads and drill heads, brushes, and motors, giving sizes, application information. Thomas C. Wilson, Inc.

COAL, ASH HANDLING

234 Fly Ash Collection — The successful and economical separation of fly ash from boiler flue gases is discussed in 28-pp Catalog G405. Explains need for collection equipment and gives physical characteristics of fly ash. Describes company's Multiclone equipment as to principle of operation, performance and advantages. Western Precipitation Corp.

235 Tractor Shovel — The engineering, design and production stories of company's HD-11G tractor shovel are pictorially presented in 8-pp Catalog MS-460. Includes specifications and describes various features which mean easier servicing for less time-down in the field, greater operator comfort. Allis-Chalmers Mfg. Company.

236 Coal Crusher — Company's WC and WS series rolling ring coal crushers are described in Bulletin 154. Emphasizes special construction elements that mean greater coal reduction at lower operating costs. Cross section illustration shows both feeding and crushing action incorporated and tables give capacities, speeds, and dimensions. American Pulverizer Co.

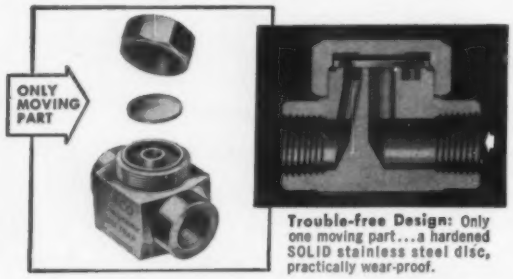
237 Why Liquid Diffusion — What liquid diffusion can do for power plants is explained in Form B, which tells how liquid diffusion compounds work and gives four practical applications. These include dust control in coal handling, fly-ash control, coal storage pile treatment and boiler cleaning. Johnson-March Corp.

WATER CONDITIONING

238 Feedwater Treating — Bulletin 1855, 30 pp, features manufacturer's hot process Accelerator for treatment of boiler feedwater, illustrating and explaining its operation and advantages, also optional equipment. Contains excellent discussion of necessity for treatment of makeup water, selection of proper equipment. Also covers the limitations of hot process softening. Infilco Inc.

239 Demineralizers — Valuable information on demineralization is offered power engineers in comprehensive 24-pp

SARCO TYPE TD THERMODYNAMIC STEAM TRAP



Trouble-free Design: Only one moving part...a hardened SOLID stainless steel disc, practically wear-proof.

NEW STEAM TRAP

EMPLOYS RADICALLY NEW PRINCIPLE!

Kinetic energy of steam closes the valve!

• • •

MANY ADVANTAGES

1. No valve-closing mechanism to wear or stick.
2. *Same* TD trap for 10-600 psi... light or heavy loads... without seat or valve change or other adjustments.
3. Only *one* moving part... a hardened *solid* stainless steel disc... practically wear-proof.
4. Only 3 parts...cap, disc and body...all stainless steel.
5. No critical clearances to choke. No gaskets to leak.
6. Not affected by superheat, water-hammer, corrosive condensate.
7. Closes tight on no load.

60-Day Trial Convinces

Ask for 60-day trial without obligation... specify size and use. Write for Bulletin 257.

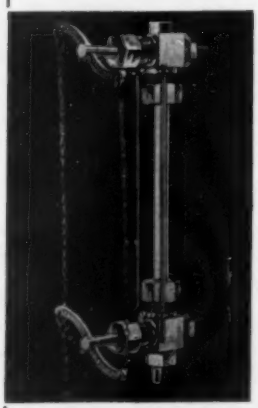
2156-P

SARCO COMPANY, INC.
EMPIRE STATE BLDG., N.Y. 1, N.Y.

For more data circle 572 on Post Card

PBH Water Gauges

QUICK CLOSING—Gauges opened or shut with one quarter turn providing quick shut-off of danger and expense.



STEAM PROOF AND LEAK-TIGHT. Extra deep stuffing box nuts with ample size high quality composition packing.

MEET A. S. M. E. CODE. Valves are made of A.S.M.E. bronze stamped with maximum working pressure. Operating chain handles furnished complying with Code requirements.

All valves rigidly tested and inspected before shipment.

Send for a copy of Catalog A-51

•

Our 60th Year

THE PAUL B. HUYETTE CO., INC.
401 NORTH BROAD STREET PHILADELPHIA 8, PA.

For more data circle 573 on Post Card

Bulletin WC-111. Discusses demineralization in general and its advantages and applications. Basic types of demineralizers and their special uses are charted. Resins, piping, valves and accessory equipment are treated in detail. Book also provides flow charts showing demineralization systems for chemical plants and power plants. Graver Water Conditioning Co.

240 Handbook on Demineralizing — Comprehensive 40-pp Bulletin 5800-B compares various methods of water treatment, indicating the comparison between demineralizers and evaporators. It discusses the characteristics of the various types of available cation and anion exchange materials and offers data on operating costs of demineralizing. It tells when to use 2-bed, 3-bed, 4-bed, mixed or monobed demineralizers. It also indicates when decarbonators or vacuum deaerators should be installed. Cochrane Corp.

241 Steam System Treatment — This bulletin on Coravol for prevention of corrosion explains theory of corrosion, application of organic amines to steam systems (Coravol process) and presents case histories of use in different types of plants and industries. Coravol is part of a complete technical service providing chemical formulas for treatment of water, steam, brine, fuel. Western Chemical Co.

243 Water Treatment — Bulletin 5000, 24 pp, explains the reasons for boiler water treatment and tells services offered by company in providing formulations for individual plant requirements. Covers pretreatment, internal treatment, treatment application, blow-down adjustment, test control. Dearborn Chemical Co.

244 Corrosion Treatment — "Corrosion Protection of Steam and Condensate Return Systems" is a folder on amine treatment for boiler and condensate systems. This treatment is described as affording surface protection of the metal as well as raising pH value of condensate. The Bird-Archer Co.

245 Water Conditioning Data Book — An excellent reference volume, Data Book 2478A contains 108 pp and presents a compilation of 78 chapters and tables. Subjects covered include hydraulics; impurities in water; chemical conversions; coagulant, acid and alkali dosages; chemicals used in water treatment; water treatment processes; boiler feed make-up requirements; alkalinity relationships; specific gravities; chemical reactions. Available to qualified power engineers, please state your job title when requesting this. The Permutit Co.

246 pH and Chlorine Control — The 12th edition of company's handbook "Modern pH and Chlorine Control," 100-pp, incorporating theory and practice of colorimetric analysis, serves as a reference for quantitative determination of pH, chlorine, phosphate, nitrite, sulfate, hardness and other tests. Slide comparators and complete test kits are illustrated. In addition to standard pH determinations, methods are outlined for quantitative analyses of phosphate, calcium, magnesium, silica nitrate hardness in feedwater. Available to qualified power engineers. W. A. Taylor Co.

248 Feedwater Treatment — Process Bulletin B1, "Treatment of Boiler Feedwater by Direct, or Internal Method," discusses advantages of direct treatment, as a complete treating program or as a supplement to external systems. Explains why direct treatment is convenient, economical and complete, and points out how it improves steam quality and reduces boiler maintenance costs and downtime. National Aluminate Corp.

249 For Water Wells — An acidizing service for water wells, designed to increase water yield by enlarging formation channels and by removing scale deposits from pumps and screens is described in this folder. Lists advantages of this service, and cites some case histories. Dowell Inc.

ELECTRICAL EQUIPMENT

251 Motor-Generator Reference Book — Publication 51R7933 is a 50-pp booklet compiled to assist in the selection of motive power to handle most industrial applications. Neither textbook nor ordering catalog, this book provides a brief outline of the various types of motors, generators and motor-generator sets, telling their applications and operating requirements. Booklet is generously illustrated and includes performance data, ratings, as well as detailed information on speed control. Allis-Chalmers Mfg. Co.

252 Motor Buying Guide — Bulletin GEC-1026, 28-pp, features company's standard a-c fractional and integral horsepower motors in most general use. Included are general- and definite-purpose fhp motors, and fhp gear motors. A section on selection of integral horsepower motors covers horsepower requirements, enclosures, starting current limitations, speeds,

For more data circle 574 on Post Card

BOWSER
ESTABLISHED 1885
LEADING IN LIQUID-HANDLING EQUIPMENT FOR INDUSTRY
METERING 1
Bowser meters record and control fuel and industrial liquids for accurate accounting.
FILTERING 2
Bowser-filtered fuel protects costly equipment. Replaceable cartridges deliver clean, polished filtrate at low cost. Used for fuel and process liquids.
3 LUBRICATION
Bowser systems keep lube oils dry and clean. Stop bearing failures. Oil lasts longer. Power equipment is protected.
Wherever liquids are handled for power, process or production, Bowser engineers work with plant engineers to improve efficiency.
Write for data.
BOWSER NATIONWIDE SALES AND SERVICE
REGIONAL OFFICES
ATLANTA • BOSTON • CHICAGO • CLEVELAND • DALLAS
KANSAS CITY • LOS ANGELES • NEW YORK • SAN FRANCISCO
BOWSER, INC., 1351 E. CREIGHTON, FORT WAYNE, INDIANA

For more data circle 575 on Post Card

motor types, and selection of fuses and circuit breakers. Descriptions and specifications include single-phase, polyphase, totally enclosed fan cooled, and gear-type integral horsepower motors. Ratings, book prices, dimensions, frame numbers are included. General Electric Co.

253 Insulation Temperature-Resistance — Technical Publication 21T4, 16 pp, is an article on temperature-resistance characteristics of electrical insulation. Complete with tables and graphs, gives general information on variations in temperature characteristics, composite nature of electrical insulation, and practicability of temperature compensation. Other chapters deal with determining insulation constants for temperature correction factors, and a practical method of obtaining insulation temperature is outlined and described. James G. Biddle Co.

254 High-Capacity Fuses — Form HCS, 6 pp, describes fuses of unlimited interrupting capacity on voltages to 600, designed to afford protection for loads of 600 to 5000 amp. Includes test data, charts on opening time, current limiting effect. Bussmann Mfg. Co.

LUBRICATION

255 Turbine Lubrication — The special problems of turbine lubrication are discussed in 8-pp Bulletin TU-1. Tells how purifiers keep power units in service; discusses inhibited and uninhibited oils, company's process for reducing sludge formation within lubrication system. Illustrated with diagrams of typical installations. DeLaval Separator Co.

256 Bearing Lubrication — Vol. XL, No. 10 of this company's Lubrication magazine provides an excellent 12-pp article on industrial bearing lubrication. Illustrated with photos and drawings, text covers such subjects as bearing design; bearing surfaces; bearing overhaul; aspects of lubrication, including factors involved in choice of turbine oils and diesel lubricants, and the deleterious effects of moisture; and the life expectancy of bearing lubricants. The Texas Co.

257 Lithium Soap Greases — This product information bulletin details qualities and specifications of company's multi-purpose lithium soap industrial greases. Advantages of multi-purpose grease use — such as prevention of lubricant misapplication, simplified maintenance procedures discussed, together with performance characteristics. Sinclair Refining Co.

INSTRUMENTS AND CONTROLS

259 Metering and Control Equipment — Sixteen-pp Bulletin 18 is a comprehensive catalog offering information on company's meters, control equipment and engineering services. It is written for engineers in power plants, public utilities and process plants. Fifteen measured variables common to power and process operations form the index for selecting appropriate equipment. Bailey Meter Co.

260 Boiler Feed Control — Bulletin 1003, a 12-pp catalog on boiler feed regulators, is illustrated with large application photos and detailed schematic drawings and charts. Relay and direct operation are covered. Case studies of representative boiler loads are presented to show stability of the Flowmatics in controlling feedwater automatically. Copes-Vulcan Div., Blaw-Knox Co.

261 Bi-Color Gage — Bulletin 1174 gives advantages of company's Multi-Port bi-color gage made for boiler operating pressures to 3000 psi. Points out chief design features, illustrates construction details through photos and drawings. Installation methods are also treated. Diamond Power Specialty Corp.

262 Instruments, Controls — Condensed Catalog 1537 offers brief application information on manufacturer's line of instruments. Fully illustrated, covers draft and pressure instruments, flow meters, liquid levels and pressure gages, CO meters, pneumatic transmitters, positioning operators, temperature instruments, boiler feedwater controls, others. Includes references to detailed literature on each type of equipment. Republic Flow Meters Co.

263 Easy Reading Gage — An all-hydrostatic remote reading gage for boiler water and other liquid levels is described in Catalog 500, Section CO. Pictures improved visibility, other advantages offered by this gage, explains operation. The Reliance Gauge Column Co.

PUMPS, PUMPING

264 Boiler Feed Pump — A barrel-type boiler feed pump for high pressure, high temperature service and designed to go on the line quickly without preliminary warm-up is the subject of 12-pp Bulletin 1525. De Laval Steam Turbine Co.

Read what users say about SK Pumping, Heating, Straining Units
"We have operated our plant with your equipment for the past twenty-five years and it has given us satisfactory performance. During this period, we have had no shutdown due to any failure of your units. We would recommend your equipment to prospective customers."
THE CRACKER JACK CO.
Chicago, Illinois
". . . we are mighty happy to report that we have had excellent service from our fuel oil burning equipment which we have had in use for some seven years. As far as we know, this equipment has not given us any difficulty in its operation and also has been very efficient."
THE CRYSTAL TISSUE COMPANY
Middletown, Ohio
Send for a copy of Bulletin 16H on SK Pumping, Heating, and Straining Units. Write to address below.
Schutte and Koerting
COMPANY
MANUFACTURING ENGINEERS
2221 STATE ROAD, CORNWELLS HEIGHTS, BUCKS COUNTY, PA.
Jet Apparatus: Ask for Condensed Bulletin J-1.
Rotameters & Flow Indicators: Ask for Condensed Bulletin 18-RA.
Valves: Ask for Condensed Bulletin V-1.
Heat Transfer Apparatus: Ask for Condensed Bulletin HT-1.
Gear Pumps: Ask for Bulletin 17-A.

Sign Your

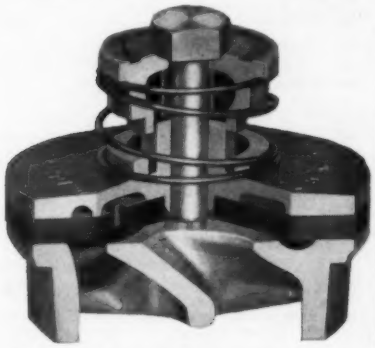
DECLARATION OF INDEPENDENCE

☆

Buy U. S. Savings Bonds!

For more data circle 576 on Post Card

SIMS INCLINED PORT ROTATING PUMP **VALVES**



Guaranteed to:

1. REDUCE Seat and Disc Wear.
2. INCREASE Pump Capacity.
3. REDUCE Maintenance Costs.
4. WORK Efficiently in Light or Heavy Liquids.

Sims Valves are available for all reciprocating pumps from stock.

Write for New Catalog PE-4

Sims
PUMP VALVE CO., INC.
1314 Park Avenue Hoboken, N. J.

For more data circle 578 on Post Card

ERNST
STAINLESS STEEL
GAGE OR IRON

Send for Catalog
Phone Livingston 6-1400
ERNST WATER COLUMN & GAGE CO.
LIVINGSTON, N. J.

For more data circle 579 on Post Card

265 Controlled Volume Pumps — Bulletin 953, 24-pp, describes and illustrates use of controlled volume pumps in industrial water treating systems. Construction and operation features are described, capacity-pressure ranges and speed and stroke length adjustments are charted. Typical chemical feed and water treating systems are presented through text and diagrams; and an analysis of boiler water treating systems, cooling water treating problems, and systems for waste and sanitary water treatment included. Milton Roy Co.

OTHER EQUIPMENT

266 Steam Accumulator — How the steam supply and demand can be balanced by means of company's steam accumulator is told in Bulletin RA-52-8. Stresses reduced boiler capacity required and increased boiler efficiency afforded by use of the accumulator, other advantages. Discusses operating principle, tells how to figure capacity. Foster Wheeler Corp.

267 Fluid Drives — Bulletins 9419 and 9519 are an illustrated catalog and selection guide on company's new Type VS Class 2 Gyrol fluid drives. Catalog discusses advantages and applications of the drives, covering speed control, power savings, simplified installation, etc. A sectional view shows construction and principle of operation. Dimensions for six sizes of drives are provided. Selection guide consists of tables indicating proper drive to use. American Blower Corp.

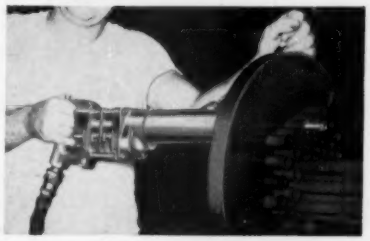
268 Process Heating Equipment — Bulletin DV presents process heating equipment for use with Dowtherm A and E, Para-Cymene, Arclor 1248 and heat transfer oil. Described and illustrated are vaporizers (both packaged and field erected units), electrically-heated vaporizers and forced circulation liquid heating and cooling units which can be used to provide a wide range of controlled temperatures at low pressures. Union Iron Works.

269 Speed Reducers — Design and operation advantages of company's line of Torque-Arm speed reducers are outlined in 28-pp Bulletin A-637. Includes selection tables for double and single reduction units, bore dimensions and bushings, data on overload releases, flange mounted speed reducers, and recommended V-belt drives. Dodge Mfg. Corp.

270 On Cooling Tower Wood — The protection of cooling tower wood is the subject of Technical Paper 130. Explains how chemical and bacteriological attack can be controlled by acid treatment and wood preservatives to kill fungi. W. H. & L. D. Betz.

272 Steam Turbines — The advantages of company's solid wheel turbines, axial flow turbines, single stage and multistage, are outlined in illustrated Bulletin S-140. Describes various models in their line and includes application photos. The Terry Steam Turbine Co.

273 Oil and Gas Burners — Bulletin OB-53, 28 pp, gives principles of selection and application of oil or gas burners, or a combination of both for standard and wide capacity range operation, together with air registers and fuel oil heating and pumping sets. Conversion table shows approximate relationships between quantity of oil burned, boiler capacity and air required for combustion. The Engineer Co.



Here's the modern, cost-saving method of removing leaky or damaged tubes from heat exchangers and condensers. With the AIRETOOL Internal Tube Cutter you accomplish overhauls in short order . . . eliminate costly downtime . . . replace faulty tubes in HOURS, not DAYS! A powerful single-stage air motor drives this fast-cutting lightweight tool. Two self-centering hardened tool steel cutting blades quickly and easily cut steel or non-ferrous tubes, internally, from ⅝" to 2½" O.D., 12 to 20 gauge, through tube sheet thicknesses of 1 inch to 4 inches. Adjustable ball bearing thrust collar prevents friction or binding while a positive feed control permits the operator to govern the cutting rate. For full complete information on the AIRETOOL Internal Tube Cutter, see your nearest AIRETOOL representative, or contact the AIRETOOL Mfg. Co. for illustrated literature.

REPRESENTATIVES: in principal cities of U.S.A., Canada, Mexico, England, Puerto Rico, Hawaii, South America, Italy, Japan.
EUROPEAN PLANT:
Vlaardingen, The Netherlands

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

BRANCH OFFICES:
New York, Chicago, Philadelphia, Tulsa, Houston, Baton Rouge.

For more data circle 580 on Post Card

ADVERTISERS' INDEX

AIR PREHEATER CORP., INC. ..... *
Agency—G. M. Basford Company
AIRETOOL MFG. CO. 139
Agency—Harry M. Miller, Inc.
ALCO PRODUCTS INC. 123
Agency—Hazard Advertising Co.
ALLIS-CHALMERS MFG. CO. 29
Agency—Compton Advertising Inc.
ALLIS-CHALMERS MFG. CO. (TRACTOR DIV.) .... *
Agency—Bert S. Gittins Advertising
AMERICAN BLOWER CORP. 14–15
Agency—Brooke, Smith, French & Dorrance, Inc.
AMERICAN BRASS CO. 19
Agency—Kenyon & Eckhardt Inc.
AMERICAN CHAIN & CABLE CO., INC. ..... *
Agency—Reincke, Meyer & Finn, Inc.
AMERICAN CHIMNEY CORP. 137
AMERICAN ENGINEERING CO. 53
Agency—Beatty and Oliver, Inc.
AMERICAN PULVERIZER CO. 126
Agency—Batz-Hodgson-Neuwaehner
AMERICAN WATER SOFTENER CO., INC. ..... *
Agency—Willard G. Myers Advertising Agency
ARMSTRONG MACHINE WORKS 125
Agency—Russell T. Gray, Inc.

BABBITT STEAM SPECIALTY CO. ..... *
Agency—George T. Metcalf Co.
BABCOCK & WILCOX CO., THE 116–117
Agency—O. S. Tyson and Co., Inc.
BAILEY METER COMPANY 34
Agency—Fuller & Smith & Ross, Inc.
BALDWIN-HILL CO. 50
Agency—Eldridge, Inc.
BALTIMORE & OHIO RR. 49
Agency—Richard A. Foley, Inc.
BARCO MANUFACTURING CO. 39
Agency—Armstrong Advertising Agency
BECKMAN, ARNOLD O., INC. ..... *
Agency—Dozier-Eastman & Co.
BELL & ZOLLER COAL COMPANY 2
Agency—George H. Hartman Co.
BELMONT PACKING & RUBBER CO., THE ..... *
Agency—The Michener Co.
BETZ, W. H. & L. D. 105
Agency—The Michener Co.
BIDDLE CO., JAMES G. 62
Agency—The Roland G. E. Ullman Organization, Inc.
BIRD-ARCHER CO., THE 131
Agency—The Roland G. E. Ullman Org.
BOILER ENGINEERING & SUPPLY CO. ..... *
Agency—John B. Ferguson Jr.
BOTFIELD REFRACTORIES ..... *
Agency—R. E. Lovekin Corp.
BOWSER, INC. 137
Agency—Willis S. Martin Co.
BRIDGEPORT BRASS CO. ..... *
Agency—Hazard Advertising Co., Inc.
WM. BROS. BOILER & MFG. CO. ..... *
Agency—The Alfred Colle Co.
BUSSMANN MFG. CO. 16–17
BYRON-JACKSON DIV., BORG-WARNER CORP. ... *
Agency—Ramsey, Brown & Co.

C & D BATTERIES ..... *
Agency—John T. Hall & Co.
CAMBRIDGE INSTRUMENT CO., INC. ..... *
Agency—E. M. Freystadt Associates, Inc.
A. J. CAMPBELL CO. ..... *
Agency—The McCarty Co.
CHAPMAN VALVE MFG. CO., THE .. Inside Back Cover
Agency—Sutherland-Abbott
CHESAPEAKE & OHIO RAILROAD 42
Agency—Robert Conahay, Inc.
CLEAVER BROOKS CO. (BOILER DIV.) ..... *
Agency—Klau-Van Pietersom-Dunlap, Inc.
CLEVELAND FUEL EQUIPMENT CO. ..... *
Agency—G. M. Basford Co.
COCHRANE CORPORATION ..... *
Agency—Hening & Co., Inc.
COMBUSTION ENGINEERING, INC. 44–45
Agency—G. M. Basford Company
CONDENSER SERVICE AND ENGINEERING 130
Agency—Diener & Dorskind, Inc.
COPES-VULCAN DIV., BLAW-KNOX CO. 47
Agency—Ketchum, MacLeod & Grove, Inc.
CRANE CO. 57
Agency—The Buchen Company
CRANE PACKING CO. 128
Agency—Symonds, MacKenzie & Co., Inc.

DAVIS ENGINEERING CORPORATION ..... *
Agency—Thomas & Delehanty, Inc.
DEARBORN CHEMICAL CO. 46
Agency—The Buchen Co.
DE LAVAL SEPARATOR CO., THE 132
Agency—Donahue & Coe, Inc.
DE LAVAL STEAM TURBINE CO. 55
Agency—Michel-Cather, Inc.
DETROIT STOKER COMPANY ..... *
Agency—Witte & Burden
DIAMOND POWER SPECIALTY CORP. 109
Agency—Witte & Burden
DODGE MANUFACTURING CO. 118, 119
Agency—Lampart, Fox, Prell & Dolk Inc.
DOWELL INCORPORATED 27
Agency—MacManus, John & Adams, Inc.

ECONOMY FUSE & MFG. CO. ..... *
Agency—Van Auken, Ragland & Stevens
EDISON, THOMAS A. ..... *
Agency—Gaynor, Colman Prentis & Varkey, Inc.
EDWARD VALVES, INC. ..... *
Agency—Marsteller, Rickard, Gebhardt & Reed, Inc.
ELLIOTT CO. ..... *
Agency—Peterson & Kempner, Inc.
ELLISON DRAFT GAGE CO. ..... *
Agency—Tri-State Advertising Co., Inc.
ENGINEER CO., THE ..... *
Agency—Michel-Cather, Inc.
ERIE CITY IRON WORKS 20–21
Agency—Davies and McKinney
ERNST WATER COLUMN & GAGE CO. 139
EVERLASTING VALVE CO. ..... *
Agency—Michel-Cather, Inc.

FLEXONICS CORP. ..... *
Agency—Russell T. Gray, Inc.
FOSTER WHEELER CORP. 36–37, 113
Agency—Marsteller, Rickard, Gebhardt & Reed, Inc.
FULLER CO. 63
Agency—O. S. Tyson & Co., Inc.

GARLOCK PACKING CO., THE ..... *
Agency—Hutchins Advertising Company, Inc.
GENERAL ELECTRIC CO. ..... *
Agency—G. M. Basford Co.
GOODALL RUBBER CO. ..... *
Agency—George C. Taylor Advertising

HAGAN CORPORATION ..... *
Agency—Ketchum, MacLeod & Grove, Inc.
HALL LABORATORIES, INC. 41
Agency—Ketchum, MacLeod & Grove, Inc.
HAYS CORPORATION, THE ..... *
Agency—Proebsting, Taylor, Inc.
HENSZEY COMPANY ..... *
Agency—Keck Advertising Agency
HILLARD CORP., THE ..... *
Agency—Mellor Advertising Agency, Inc.
HUYETTE CO., INC. PAUL B. 136

ILLINOIS WATER TREATMENT CO. ..... *
Agency—Cummings, Brand & McPherson
INFILCO INC. 142
Agency—Willard G. Gregory & Co.
INSTROF, INC. ..... *
Agency—R. E. Lovekin Corp.
INTERNATIONAL NICKEL COMPANY, INC., THE .. 38
Agency—Marschalk & Pratt Co. Division of McCann-Erickson, Inc.

JERGUSON GAGE & VALVE ..... *
Agency—Roy Elliott Co.
JOHNS-MANVILLE ..... *
Agency—J. Walter Thompson Company
JOHNSON-MARCH CORP. ..... *
Agency—Beaumont, Heller & Sperling, Inc.

E. KEELER CO. ..... *
Agency—Charles W. Williams Advertising
KIRK & BLUM MFG. CO. 30
Agency—The S. C. Baer Co.
KOR CORPORATION ..... *
KULJIAN CORP. ..... *
Agency—The Roland G. E. Ullman Org.

LACLEDE CHRISTY CO., DIVISION H. K. PORTER CO., INC. ..... *
Agency—Arthur R. MacDonald, Inc.
LADISH CO. ..... *
Agency—The Cramer-Krasselt Co.
LEFAX PUBLISHERS ..... *
Agency—H. Lesseraux
LESLIE CO. ..... *
Agency—Reid, Decker & Strocki, Inc.

MADDEN CORP., THE 141
Agency—Kreicker & Molane, Inc.
MANNING, MAXWELL & MOORE, INC. 65
Agency—Fuller & Smith & Ross, Inc.
MARLEY CO., THE 64
Agency—Valentine-Radford Advertising
MERIAM INSTRUMENT CO., THE ..... *
Agency—Thomas R. Sundheim
MILTON ROY CO. 61
Agency—The Aitken-Kynett Co.
MORTON SALT CO. 48
Agency—Needham, Louis & Brorby, Inc.
MUNDET CORK CORP., INSULATION DIV. ..... *
Agency—J. C. Bull, Inc.

NAGLE PUMPS, INC. ..... *
Agency—Tri-State Advertising Co., Inc.
NATIONAL AIROIL BURNER COMPANY, INC. ..... *
Agency—R. E. Lovekin Corp.
NATIONAL ALUMINATE CORPORATION 51, 52
Agency—Armstrong Advertising Agency
NATIONAL COAL ASSOCIATION 111
Agency—Vansant, Dugdale & Co.
NATIONAL VALVE & MFG. CO. ..... *
Agency—Bond & Starr, Inc.
NEW ENGLAND CARBIDE TOOL CO. ..... *
Agency—Callaway Association

NIAGARA BLOWER COMPANY ..... *
Agency—The Moss-Chase Company
NORDEN-KETAY CORP. ..... *
Agency—Hicks & Greist, Inc.
NORTH AMERICAN AVIATION, INC. 31
Agency—Batten, Barton, Durstine & Osborn

OHIO INJECTOR CO. ..... Inside Front Cover
Agency—Fuller & Smith & Ross, Inc.
OLD BEN COAL CO. 22
Agency—W. S. Kirkland Advertising
ORR & SEMBOWER, INC. ..... *
Agency—Beaumont, Heller & Sperling, Inc.

PACIFIC PUMPS, INC. ..... *
Agency—The McCarty Co.
PEABODY ENG. CORP. ..... *
Agency—Richard LaFond Adv. Inc.
PEERLESS PUMPS DIV. FOOD MACHINERY & C. CHEMICAL CORP. ..... *
Agency—The McCarty Co.
PERMUTIT CO., THE ..... *
Agency—Cunningham & Walsh, Inc.
PHILADELPHIA PUMP & MACHINERY CO. ..... *
Agency—The Michener Co.
H. A. PHILIPS ..... *
Agency—Glen-Jordan-Stoetzel, Inc.
PITTSBURGH PIPING & EQUIPMENT CO. 1
Agency—W. S. Hill Co.
POWELL VALVES 40
Agency—The Ralph H. Jones Co.
PREFERRED UTILITIES MFG. CORP. 120
Agency—Spooner & Kriegel

QUAKER RUBBER CORP. DIVISION OF H. K. PORTER CO., INC. OF PITTSBURGH 5
Agency—Fox & MacKenzie Advertising

RAYBESTOS-MANHATTAN, INC. 114
Agency—Gray & Rogers
REFRACTORY & INSULATION CORP. 135
Agency—Spooner & Kriegel
RELIANCE GAUGE COLUMN COMPANY 122
Agency—Carr Liggett Advertising, Inc.
REPUBLIC FLOW METERS CO. 10–11
Agency—Glenn, Jordan, Stoetzel, Inc.
REVERE COPPER AND BRASS, INC. 43
Agency—St. Georges & Keys, Inc.
RIC-WIL INC. ..... *
Agency—Ritchie & Sattler, Inc.
RILEY STOKER CORPORATION 12–13
Agency—The Davis Press, Inc.
ROCKWELL CO., W. S. 141
Agency—Spooner & Kriegel
ROSS HEAT EXCHANGER DIVISION ..... *
Agency—Harold Warner Co.
ROTO DIV. OF ELLIOTT CO. 127
Agency—Jos. Vogel & Co.
R-P & VALVE DIVISION, AMERICAN CHAIN & CABLE CO., INC. ..... *
Agency—Reincke, Meyer & Finn, Inc.

SARCO COMPANY, INC. 136
Agency—Marsteller, Rickard, Gebhardt & Reed, Inc.
SCHUTTE & KOERTING CO. 138
Agency—Richardson, Thomas & Bushman, Inc.
M. SETLOW & SON, INC. ..... *
Agency—J. W. Shepard Co.
SIMS PUMP VALVE CO., INC. 139
SINCLAIR REFINING CO. 24
Agency—Morey, Humm & Johnstone, Inc.
SOUTHERN COAL CO., INC. 121
Agency—Hitchcock & Becker Advertising
SPENCE ENGINEERING CO. 35
Agency—Michel-Cather, Inc.
STANDARD OIL CO. (INDIANA) ..... *
Agency—D'Arcy Advertising Co.
STEPHENS-ADAMSON MFG. CO. ..... *
Agency—Connor Associates, Inc.
STONE & WEBSTER ENGINEERING CO. 33
Agency—Harold Cabot & Co., Inc.
STRUTHERS WELL CORP. 124
Agency—Downing Industrial Advertising Inc.
SUPERIOR COMBUSTION INDUSTRIES, INC. 129
Agency—Charles H. Davis

TAYLOR & CO., W. A. ..... *
Agency—Emery Advertising Corporation
THE TERRY STEAM TURBINE CO. 7
Agency—Gassaway Advertising Agency
TEXAS CO., THE ..... Back Cover
Agency—Erwin, Wasey & Company Inc.

ULLMAN PRODUCTS CORP. ..... *
Agency—Shelvo, Inc.
UNION IRON WORKS 18
Agency—Harold Warner Co.
U. S. ELECTRICAL MOTORS, INC. ..... *
Agency—The McCarty Co.
UNIVERSAL ATLAS CEMENT CO. 107
Agency—Batten, Barton, Durstine & Osborn, Inc.

VAN DER HORST CORP. 112
VOGT MACHINE CO., HENRY 59
Agency—Farson, Huff & Northlich

W-S FITTINGS DIVISION, H .K. PORTER CO., INC. .. 28
Agency—W. L. Towne Advertising
WESTERN CHEMICAL COMPANY 32
Agency—Carter Advertising Agency, Inc.
WESTERN PRECIPITATION CORP. ..... *
Agency—Dozier-Eastman & Co.
WILLIAMS GAUGE CO. ..... *
Agency—Downing Industrial Advertising, Inc.
WILSON, INC., THOMAS C. 23
Agency—Michel-Cather, Inc.
WORTHINGTON CORPORATION ..... *
Agency—Needham, Louis & Brorby, Inc.

YARNALL-WARING COMPANY 8–9, 65
Agency—The Michener Co.

*Firms whose advertising is not in this issue but is appearing in other issues are marked with an **

CLASSIFIED ADVERTISING

STEAM AND POWER ENGINEER

Due to our expansion program, a permanent position for a Mechanical Engineer graduate with five or more years experience in steam-electric power plant design is available in a large pulp and paper manufacturing plant in the Upper Midwest. Our employees know of this opening. Your confidential reply should include personal, educational, and work history together with salary thinking. Write Box No. 1706, POWER ENGINEERING, 110 S. Dearborn St., Chicago 3, Ill.

PLANT UTILITIES ENGINEER

Large manufacturer of heavy equipment has opening for an electrical or mechanical engineer graduate who has had experience in power and steam generation and distribution. Position will include responsibility for utilities system engineering and planning and its operation. Give complete details in first letter to

Supt. of Employment

FAIRBANKS, MORSE & CO.

Beloit 1400 Park Ave. Wisconsin

A CHALLENGE

How many of these positions are you qualified to fill? Project Manager, Mechanical Engineer, Designer, Draftsman, Squad Leader, Estimator. We are an established engineer-contracting company doing business in four states, plumbing, heating, process piping, boiler house, filter plant, and industrial piping. Not a one job proposition. We need another man who is versatile and can qualify for as many as possible of these positions. Location, Toledo, Ohio. Salary open. Give qualifications and experience. Box 1709, POWER ENGINEERING, 110 S. Dearborn Street, Chicago 3, Illinois.

J. E. SIRRINE COMPANY
Engineers

Design and Supervision of Steam and Hydro-electric Power Plants, Industrial Plants, Mechanical and Operating Surveys, Appraisals • Plans • Reports

Greenville, South Carolina

274 Heat Transfer Apparatus — Condensed Bulletin HT-1 highlights representative products in company's line of heat transfer equipment. Includes oil heaters and coolers, strainers, evaporators, heat exchangers, radiafin air coolers, tubes, pipes, and coils. Cross-section views of typical units are shown, brief descriptions given. Schutte and Koerting Co.

275 Sheet and Plate Fabrication — Illustrated in 40-pp Bulletin F-3 are products of this manufacturer, and equipment used to produce special sheet steel and alloy parts. Shows control panels, switch gear housings, cubicles and other electrical enclosures, boiler air ducts, smoke breechings, tanks. The Kirk & Blum Mfg. Co.

276 High Temp Compound — This folder describes Thred-Gard, a high temperature compound designed to eliminate seizing and galling and lubricate threaded surfaces. Tells its use as thread lubricant and in other applications in power plants, others. Crane Packing Co.

277 Technical Refrigeration — Twelve-pp Bulletin 754 covers a complete line of environmental testing and processing equipment. Provides illustrations and specifications on recently redesigned altitude, humidity, low temperature and prefabricated test chambers as well as specialized testing equipment. Includes helpful engineering data. Bowser, Inc.

278 Packings and Gaskets — Catalog P-100C, 32 pp, covers 95 most popular packings and gaskets in company's line, furnishing details of construction, service recommendations and size information. Includes charts showing applications. Packing Div., Raybestos-Manhattan, Inc.

279 Refractory Concrete — Basic information on recommended practice for mixing and placing refractory concrete, used in the metal, power, ceramic, and petroleum refining industry as a material to withstand service temp to 2600 F or more, is presented in this 16-pp manual. Sections are devoted to special properties of refractory concrete, aggregates, refractory insulating concrete, and structural design. Universal Atlas Cement Co.

THE LUMMUS COMPANY
Engineers and Constructors

385 Madison Avenue, New York, N. Y.

Chicago — Houston — London — Paris — The Hague — Montreal — Caracas — Bombay

What's the low-down on blow-down?

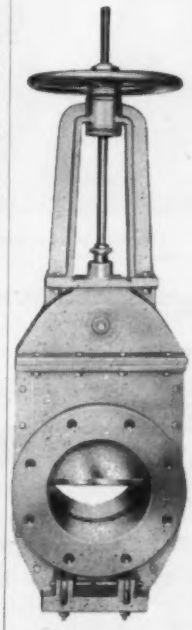
The whole story will probably surprise you. It is true, for example, that about 90% of all boiler blow-down today is still hit-or-miss. It's also true that equipment to do the job right can save enough wasted heat units to pay its own way in a matter of months. To get all the eye-opening facts send a card, letter or wire to *The Madden Corp., 1543 W. Morse Ave., Chicago 26, Ill.*, and ask for "Blow-Down Low-down."

For more data circle 581 on Post Card

KWIKLEENS
for Materials that Clog Ordinary Valves

NON-CLOGGING FULL FLOW AREA

Low Pressure Type



Heavy Duty Type to 60 p.s.i.

For air, gases or liquids containing a high percentage of solids, fly ash, free-flowing granular solids or pulp stock that clog or jam ordinary valves, solve your problem with Kwikleen Slide Valves. Not necessary to disconnect from pipe line for cleaning. Made in all sizes; with manual or air cylinder operators.

W. S. ROCKWELL COMPANY

ROCKWELL SINCE 1888 BUILT

2946 ELIOT STREET
FAIRFIELD, CONN.

VALVES

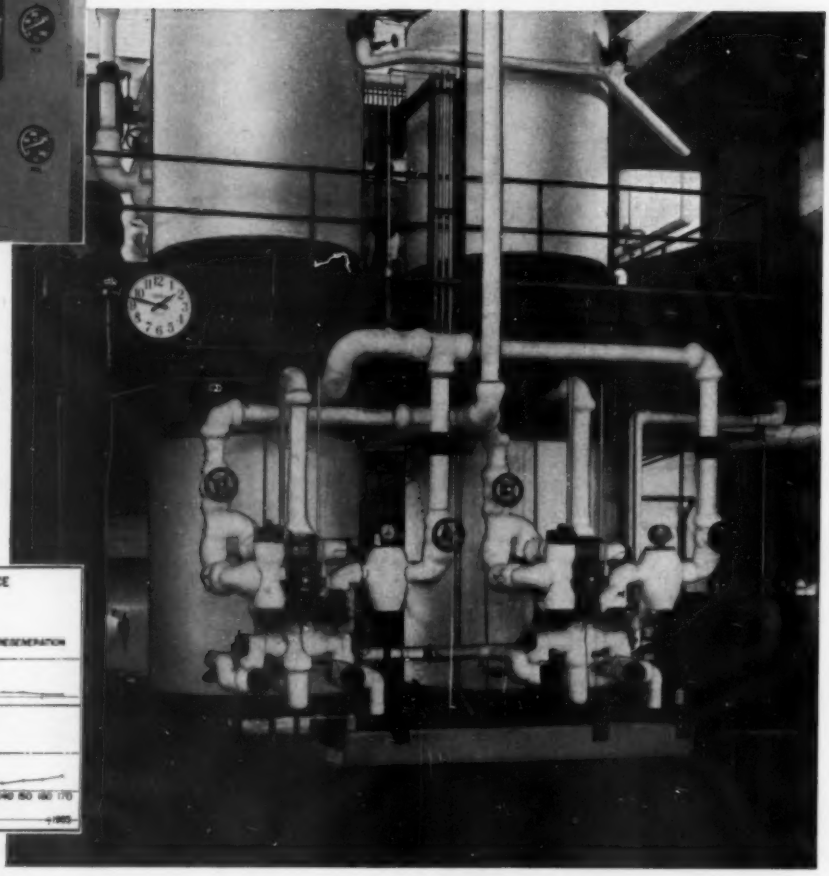
Butterfly • Slide • Check
Swing Gate • Proportioning

For more data circle 582 on Post Card

Here's Why Utilities Can Depend on

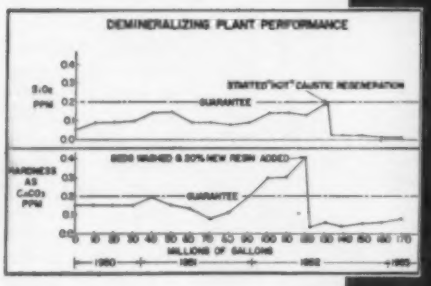
CATEXER® ANEXER®
DEMINERALIZATION PLANTS

Control panel designed and assembled by INFILCO



Waukegan Station Demineralization Plant

"CATEXER" "ANEXER" Demineralization Plant performance charts at Waukegan Station.



Six years ago, INFILCO pioneered the first large scale use of demineralization and silica removal by ion exchange for makeup to high pressure boilers at Commonwealth Edison Company's Waukegan Station. Accurate records show that this 240 gallon per minute fully automatic plant consistently produces an adequate supply of high-quality feedwater for both medium and high-pressure boilers. Now, six years after it was first put in operation, the plant is still doing the job for which it was designed.

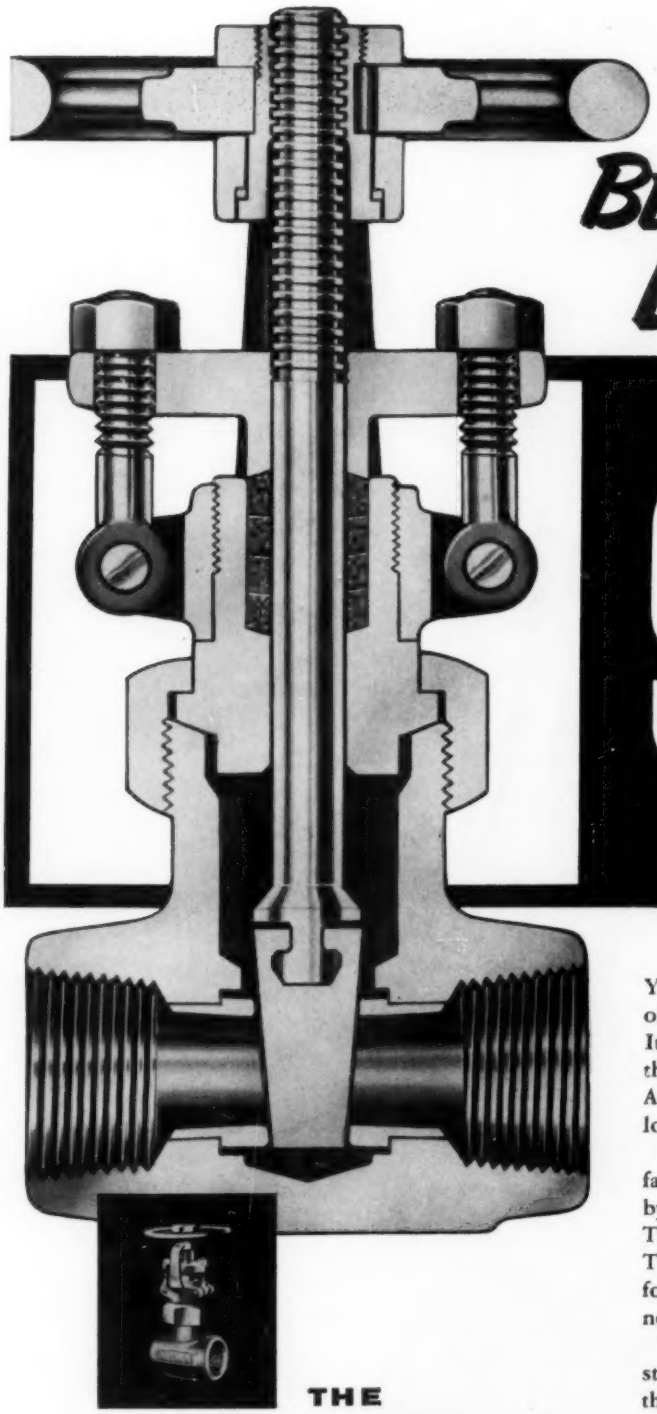
When you specify an INFILCO Demineralization Plant, you can rely on its performance because it is designed by a firm with the widest range of engineering know-how in the water and waste treatment field. For more information see your Consulting Engineer or write.

INFILCO

The one company offering equipment for all types of water and waste treatment, coagulation, precipitation, sedimentation flotation, filtration, ion exchange and biological purification.

INFILCO INC. 918 South Campbell Avenue, Tucson, Arizona
Offices in principal cities in North America 8524

For more data circle 583 on Post Card



DOES A BETTER JOB AT LOWER COST

CHAPMAN LIST

960

SMALL FORGED STEEL GATE VALVE

You'll find Chapman List 960 specified and used on more jobs than any other valve of its kind. It has the range . . . the construction . . . the tightness . . . and smooth operation you need. And it keeps your maintenance down to a new low even under severe working conditions.

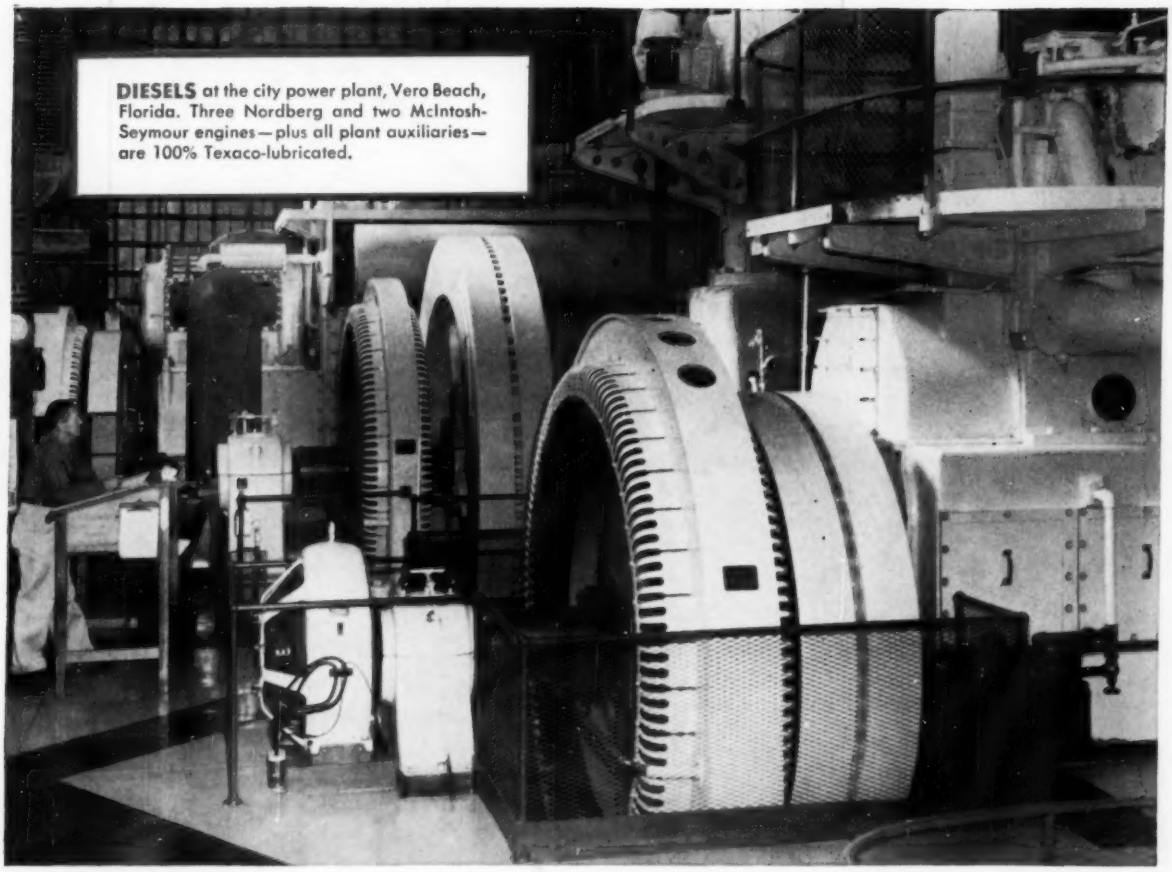
There's no seizing or galling. Wedge gate faces are super tough . . . hardened to 800 Brinell by Chapman's exclusive Malcomizing process. There are no full-pressure repacking difficulties. Taper shouldered stem seats snugly in bonnet forging. Stem-and-gate connections are now 50% stronger than ever before.

With its easily replaceable, hardened stainless steel seat rings, Chapman List 960 is the valve that keeps its mind on the job in multiple applications. Sizes from ¼" to 2" . . . in many different alloys. Rising stem with yoke or rising stem with inside screw. Pressures from 380 psi at 1000° F to 2000 psi at 100° F. If higher, get Chapman List 990.

Full information is in our Catalog 10. Get it. Read it. See for yourself why Chapman List 960 is known more and more every day as the valve man's valve. Write for it now.

THE
CHAPMAN
VALVE MFG. COMPANY
INDIAN ORCHARD
MASSACHUSETTS

For more data circle 584 on Post Card



DIESELS at the city power plant, Vero Beach, Florida. Three Nordberg and two McIntosh-Seymour engines—plus all plant auxiliaries—are 100% Texaco-lubricated.

Comparison Proves TEXACO Best for diesels at Vero Beach, Florida, power plant

The entire power plant at Vero Beach, Florida—including five diesels totaling over 12,000 h.p.—has been 100% Texaco-lubricated for the past two years. This confidence in Texaco began when *Texaco Ursa Oil* was tested against a leading competitive brand. Says Superintendent of Power Plant Fred Gossett:

"*Texaco Ursa Oil* definitely showed a superior ability to keep our diesels clean and free from deposits, prevent stuck rings and valves, reduce wear. We decided on *Texaco Ursa Oil* for all our diesels, and have been more than satisfied with the results—higher engine efficiency, lower fuel and maintenance costs."

Operators everywhere enjoy similar benefits. In fact—

For over 20 years, more stationary diesel h.p. in the U.S. has been lubricated with Texaco than with any other brand.

The complete line of *Texaco Ursa Oils* is especially refined and processed to assure *more power* with *less fuel* over *longer periods* between overhauls—for all diesels, gas and dual-fuel engines.

A Texaco Lubrication Engineer will gladly help you select the one best suited to *your* engines. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO URSA OILS

FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

TUNE IN: TEXACO STAR THEATER starring JIMMY DURANTE on TV Sat. nights. METROPOLITAN OPERA radio broadcasts Sat. afternoons.

For more data circle 585 on Post Card